

JULY

25 CENTS

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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SEE PAGE 8

SEEING *is* BELIEVING

Look inside your engine
just once *and you'll always*
use Ethyl Gasoline

DETROIT ENGINEERS put a quartz window in the top of an engine and took high speed photographs of the actual combustion of motor fuel. Here's what they saw:

Regular gasoline explodes violently—wastes part of its power banging against cylinder walls and pistons in hurried bursts of fitful energy.

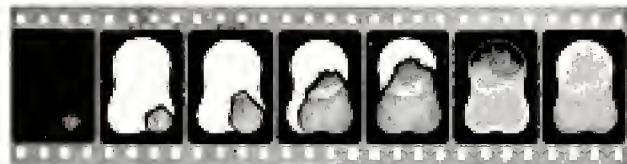
Ethyl Gasoline explodes *evenly* with a *smoothly* gathering force that delivers *more* power to the piston and leaves less waste heat. The Ethyl fluid in Ethyl Gasoline *controls* combustion.

Look at the pictures below—*see* the difference—and you will understand why more people buy Ethyl today than any other brand of motor fuel.

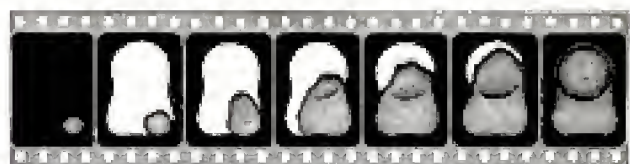
Now stop at an Ethyl pump, fill your tank with Ethyl Gasoline—and *feel* the difference it makes! Ethyl Gasoline Corporation, New York City.



Ethyl fluid contains lead © N. G. C. 1932



ORDINARY GASOLINE is in the cylinder. You see the spark in the picture at the left. In the next the gasoline vapor starts to burn. More—more—more burns. Then suddenly, in the sixth picture—**BANG!** The remaining gasoline explodes. That is **KNOCK**. The last picture shows nothing but afterglow. Knock wasted the gasoline that should be working now.



ETHYL GASOLINE starts from the spark in the same way—as shown in the first three pictures. But Ethyl can burn at only one speed, *the right speed*. See how its flame spreads *evenly* from start to finish. It is not all burned until the last picture—delivering its greatest power when the piston is going down, when power counts most in the performance of your car.

Buy **ETHYL GASOLINE**

\$14⁴⁰
A DAY

TWO CERTAIN WAYS TO Make Money at Once

\$61⁶⁰
A DAY

*In your kitchen
at home*

*with very small
investment*

*letting others
Sell for you*

Here is a business you can start for as little as \$50. And the first week of operation should bring you at least \$50 in profits. Run it from your kitchen. Let dealers do your selling, and it should be very easy to make \$50 a week regular and steady.

This is a staple food business, but one with a brand new appeal. The food business is always good. People **must** eat. In bad times they buy the foods that have the greatest food value for the least cost. In spite of being greasy, and soggy and hard to digest, old-fashioned Doughnuts are sold daily by the millions. They are one of America's favorite foods. And they are high in food value for the cost.

But now I have invented **BROWN BOBBY—A NEW AND DIFFERENT KIND OF GREASELESS DOUGH-NUT** that you bake in an electric cooker. Anyone can eat and digest as many **BROWN BOBBYS** as they want. The taste is like nothing you have ever tasted before. And **BROWN BOBBYS** sell three times as fast as the old-fashioned doughnut.

For less than your potential profits for the first week we supply you with complete equipment. You can start in your kitchen or in any space two feet square. Simply plug into any light socket, mix up ingredients in secret formula and you can have a profit the first day.

I send you fully worked out plan so you do no selling. All your production is disposed of at wholesale and dealers appointed on my plan do all your selling for you. You merely bake and deliver. And \$7.20 worth of raw materials bring back \$21.00—a profit of \$14.40 a day.

If space permitted I could give you many testimonials from grateful widows, housewives whose husbands had lost their jobs, men who were out of work, or on part pay. It is an ideal home business that can be run by a man or a woman alone or a husband and wife working together.

Check coupon for my Free Book. There is no obligation to start. But read the unvarnished facts about this wonderful little "Depression-Proof" home money-maker and then decide for yourself. No salesman will call. All information is free.

For eight years this responsible company has specialized in starting people in money-making businesses. No study, no delay—but profits at once. They now offer two separate businesses. Neither one is experimental. Both are **Proved Money-Makers!** Each one is an equally big money maker in bad times or good. One or the other is sure to bring you the money you want.

I am also the pioneer in another basic food industry. I was instrumental many years ago in starting scores of people in the highly profitable Potato Chip Business.

Many of them are still making money with the equipment I furnished them.

But my old equipment had two faults. The chips it turned out were no different from any other chips—and the price was \$1500 per machine.

Now, after years of experimenting, I have perfected a machine that can be delivered to you for an investment less than your potential profits for the first week and one that turns out a chip different to any chip you ever tasted.

Raw potatoes contain 9 Vital Health Giving Minerals. By the old way of making potato chips these 9 Minerals were removed. In addition 15.8% of the valuable mineral proteins were removed. My new process keeps these minerals in the chips—gives them an entirely new and different flavor—and makes them actually a vital mineral health food.

My machine and my chips are called **VITA-SEALD**. Although this is among the first of my public announcements, already I have received thousands of inquiries. Many machines already are in operation and the reports coming in from the operators say that **VITA-SEALD** chips are actually sweeping competition off the boards, and that the public has taken to them in droves—will buy no other kind. One operator has sold over a ton of potatoes in four weeks—another reports lining up dealers to take 100 dozen bags a day. This business, like my other one, is one you can run from your home or from any small shop.

\$2.30 worth of raw material brings you \$34.00 back—over 600% profit mark-up. Just supply dealers—at wholesale prices—and one day's output should net you \$61.60. Cut that figure in half if you like, and then show me any other home business that will bring you \$30 a day every day you operate.

Get the facts. I have personally written a book telling all of my experience with potato chips—giving my experiments and showing the actual money-making facts in this business without exaggeration. It is free. Mail the coupon and be sure to check the square showing which book you want.



Mr. Adams is a man of excellent character, high credit rating, and good standing. He is a successful business man himself and has the success of many others in his single—private—life has started in business for themselves. He has spent the better part of his life showing others how to make money and you can make no mistake in investigating his proposition.

Food Display Machine Corp., Dept. 37, 500 N. Dearborn St., Chicago, Ill.

H. ADAMS, President,
FOOD DISPLAY MACHINE CORP., Dept. 37
500 N. Dearborn St.,
Chicago, Illinois.

I am interested in making money at home and have a sufficient amount to invest if I decide to take up either one of your businesses. Please send the book I have checked below. This is free and I am not under any obligation to go ahead.

☐ How to Make \$14.40 a Day on BROWN BOBBY Greaseless Doughnuts. ☐ How to Make \$61.60 a Day on VITA-SEALD Potato Chips.

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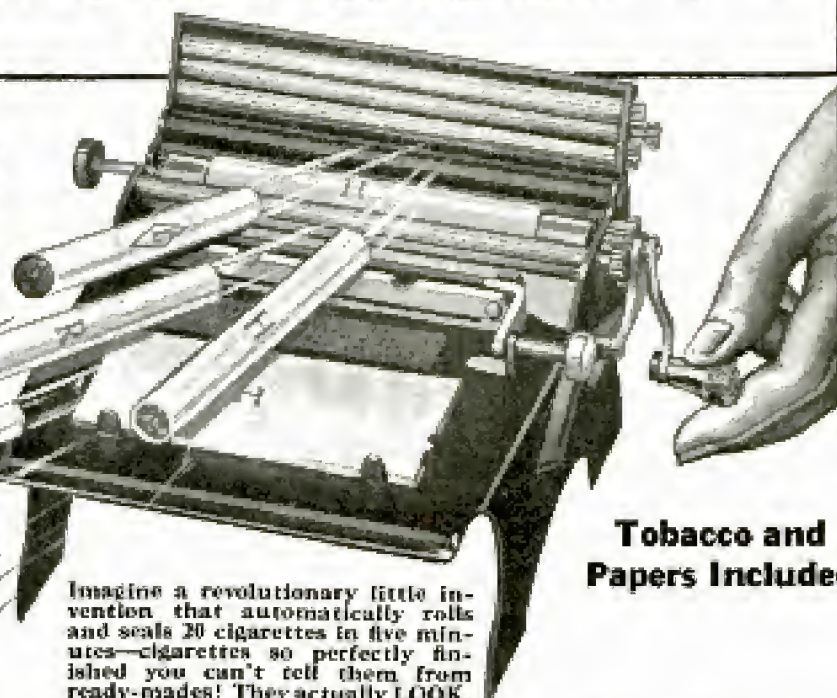
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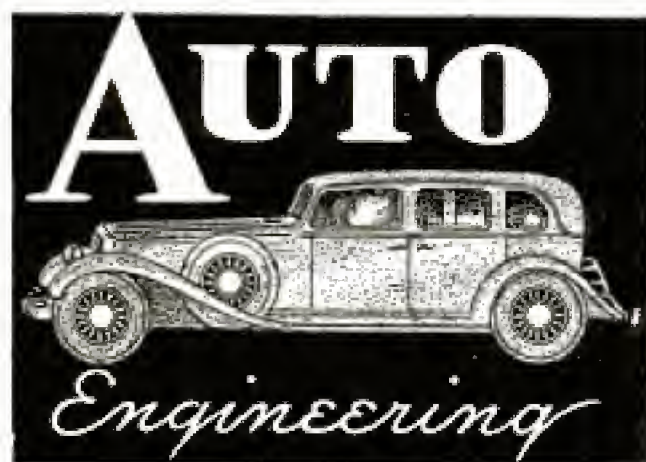
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To the man who is worried about this Depression



THIS isn't the time to waste words or to ignore facts. This depression has already put many men out of work, and threatens the earning power of others who still draw pay. It's useless to shut our eyes to it, so why try?

On the contrary, let's face the facts, calmly and without fear. Let's analyze the situation, as man to man, and find out what *you* can do to escape the depression, and perhaps even take advantage of it.

In the first place, even when prosperity returns, many of the now unemployed will not be much better off. It's not the business depression that is beating them—they are working under a depression ALL their lives. For they are trying to wrest a living from a world that asks more than they have to offer.

What business wants today—and will pay any price to get—is RESULTS! And if a man can't deliver—well, it's only a question of time before he is replaced by a man who can.

But if you can accept the challenge—if you are prepared to deliver results, this depression can be a blessing in disguise—an opportunity to climb the ladder, with the way all cleared for you. Never has business been searching more eagerly for ability, knowledge and training.

Maybe it does not appear that way to you, right now. But look around and you will see it. You will see that in this crisis the trained man has suffered far less than others. Indeed, in many cases, he has forged ahead, has even won raises and promotions and is all set for the tremendous opportunities that will inevitably come with returning good times.

But let's get down to cases—letters received during the last few months—so that you may see exactly what we mean—

These Men Are Beating the Depression

J. H. W., Michigan, writes, "I have been promoted—just one week after my superintendent learned I was taking LaSalle training in my spare time. He made a chance for me by letting out a man who was not accurate in his work."

R. P. F., Illinois, "Thanks to my training with you, I have been advanced

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F. A., Ontario, "About three weeks ago, our superintendent told me the company had a letter from LaSalle about my training. He then told me that the manager had been looking for a man to fill a vacancy and your letter had won the place for me."

E. S., Ohio, "The fact that I have increased my salary and have been promoted to the managership in the face of the depression is, I think, ample proof of the value of my LaSalle training."

J. L., California, "I have just been promoted to Assistant Traffic Manager (thanks to LaSalle). An increase in salary came with the promotion. I consider this pretty good during this period of wage cutting and economy."

What About You?

But enough of talking about others. You are interested, after all, in knowing whether *you* can beat the depression.

It depends on the kind of man you are. Many men prefer to take a licking in silence. They are waiting for the return of prosperity. Then, so they think, they will make up the ground they lost.

If you belong to this class of "waiters," this message will not interest you. Conditions will improve, and those content to ride up and down on the business wave will enjoy another temporary period of lessened apprehension and trouble.

But if you belong to the other class—if you are in earnest about winning back whatever reduction in income you have suffered and moving up into the higher salary brackets, if you are determined to get ready for the big jobs that will be seeking men, then this is *your day of opportunity*. Not tomorrow—not when business picks up—but *now*.

Times like these call for *action*. Sooner or later prosperity will return. Will you be ready for leadership—or will you be sorry for the "break" you passed up in 1932?

Why risk your future for want of a minute's time? At least find out what LaSalle training offers you. Just fill out and mail the coupon now—one minute will do it.

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HOMER J. BUCKLEY, *President, Buckley,
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TOM S. CATHERS, *City Engineer,
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I feel that I owe my present position very largely to the expert teaching and guidance I received from an I. C. S. Course.

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I consider that the study of your course was the main theoretical foundation on which I started to build an engineering career.

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IN THESE strenuous times, haven't you often wished there was some *qualified* man with whom you could discuss your problems? It might be an imposition on your friends—and besides, your friends have their own problems. And, quite naturally, their advice is based on their own observations and experiences, which are limited.

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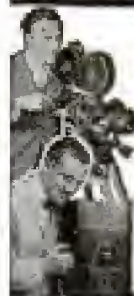
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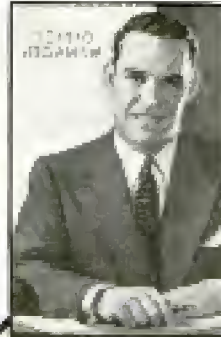
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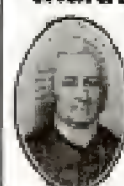


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OPERATE Chain of vending and amusement machines. Be independent for life. Start small, grow big. P. Goodbody, 1826 East Main Street, Rochester, N. Y.

OPPORTUNITIES. Unusual, fascinating, profitable. Particulars free. Economy Sales Co., Manchester, Iowa.

CHARITERS: Delaware; best, cheapest; free forms. Colonial Charter Co., Wilmington, Del.

EARN Large income with "chain" of non-mut-chewing gum vending machines. Start small capital. Particulars free. Robbion Corp., DeKalb and Broadway, Brooklyn, N. Y.

POP CORN Machines \$15 up. Money makers. Southside Co., 2117 Harding, Des Moines, Iowa.

SELL By mail. Books, novelties, bargains! Large profits. Particulars free. B. Elford, 525 S. Dearborn, Chicago.

ARTIFICIAL Marble sanitary flooring. Instructions covering wood or cement flooring 1/4 inch thick, drop-proof, all colors, low cost. Ornamental casting, concrete plaster, paper-marble decorations, garden furniture, statuary, flexible molds, particulars and illustrations free. Chris. Mahler, Elmont, N. Y.

100 Money at home plating auto parts, reflectors, mirrors, chandeliers; by new methods; experience unnecessary. Outfits furnished. Gemmett Co., Ave. N. Decorator, Ill.

MAKE Artificial marble, colored glossy tiles, no polishing; rather heavy. Novelties, tablets, bookends, figurines, whetstones. Hard, inexpensive, fireproof, enamel wood. Secret cement methods. Amazing samples 2c. John A. Parr, 945 Grande Vista Drive, Los Angeles, Calif.

AMATEUR Cartoonists: Sell your work. Write Smith's Service, PW191, Wrentham, Wash.

A BUSINESS Of your own making—Sparkling Glass Name and Number plates, Checkbookmarks, signs. Big book and sample free. E. Palmer, 510, Waukegan, Ohio.

OUTDOOR Sports for everyone—Enjoy them all year round with aid of book published by Popular Mechanics. This veritable encyclopedia not only furnishes hundreds of ideas for new and popular sports for every season of the year, but also gives complete instruction for making the necessary equipment at very small cost. 250 pages and 650 illustrations. Send today as book is full of thrills and excitement for winter sport enthusiasts. Mailed postpaid anywhere for \$2, or will be sent C. O. D. to any address in U. S. Simply pay postman when delivered. Popular Mechanics Press, Room 922, 200 East Ontario St., Chicago.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1050 W. Broad, Richmond, Va.

FIFTY Successful mail-order propositions. Address, K. Home, 2919 Metropolitan, Chicago.

CHEMISTRY

CHEMISTRY Students—Send 10c for illustrated catalogue of apparatus, chemicals, outfits and sets, including story of boy chemist who became the world's greatest inventor. Large illustrated experiment book—15c. J. H. Winn Company, 2255 Broadway, New York City.

JOIN—American Amateur Chemists Society. Journal, particulars, 10c. Lansing, Michigan.

HANDBOOK For chemical experiments, illustrated 50c. Experiment booklet 15c. Chemical catalogue 10c. General Chemical Co., Reading, Pa.

FORMULAS AND TRADE SECRETS

1,000,000 FORMULAS, Industrial facts, tables, processes, rules, trade secrets, and calculations for all kinds of Trades and Businesses. Book—"Moore's Assistant"—1916 pages. Sent postpaid for \$2.00. O'Neill Publishing Co., 57 Hous St., Dept. 22, New York.

NEW Ant exterminators. Send one dollar for latest formulas. Holland, Box 2199, Amarillo, Texas.

30 YEARS Practical auto experience back of Cook's Auto Formulas. Red stamp brings list. Geo. E. Cook, Box 281, Oyster Bay, Long Island.

FIREWORKS—Home made, instructions 50c. Signatite Co., Santa Barbara, Calif.

FREE Formula catalog, latest money makers. Western Chemical, Salem, Oregon.

TESTED Formulas. Newest, guaranteed. Catalog free. Grinstead, Chemist, Edwardsville, Illinois.

SIMPLE Way to render iron white as silver, 25c. T. Service, 375 New Jersey Ave., Brooklyn, N. Y.

PLAYSTAY Formula \$1.00 currency. Gateway Specialties, Grand City, So. Dak.

MAKE Gold and silver mirrors. Both up-to-date formulas and working instructions \$10.00. Nashville Mirror Sign Co., 614 Chimney St., Nashville, Tenn.

INSTRUCTIONS For manufacturing industrial alcohol, \$1.00. Legal, Profitable. J. Bonnell, 3717 Dough Street, Baltimore, Maryland.

512 FORMULAS Free, six cents expenses. Buzbars, 16 Jefferson, Chicago.

FORMULAS: Beverages, flavors, syrups, extracts and other processes. Valuable information free. Formula Company, 5th Ave. and Broad, Seattle, Wash.

MIRROR Restoring, electro-plating latest formulas. Portable electro-nickel plater self-made for \$1.00. Guaranteed. Custer, 85 Leslie, Highland Park, Mich.

SUCCESS With your own products. Make sell them yourself. Formulas, processes, trade secrets. Analytical service. Catalog free. H. Thaxly Co., Washington, D. C.

SUCCESS Is sure with Miller's guaranteed formulas; best science can produce for making popular, biggest-selling goods. All lines. Don't buy formulas till you've received my latest literature. Miller, Chemist, 1706-H, Tampa, Fla.

500 FORMULAS And big illustrated catalog 25c. Ideal Book Shop, Park Ridge, Ill.

FORMULAS—Our literature will surprise you. Belfort, 4012 N. Kessler, Chicago.

FORMULAS All kinds, changing free. Closer Laboratories (P), Park Ridge, Ill.

10,000 MONEY-MAKING Formulas. Tells you how to make and sell almost everything under the sun: cosmetics, medicine, anti-freeze solutions, battery solutions, beverages, cheese, chewing gum, cleaning preparations, extracts, hair preparations, ink, linoleum, leather polish, mirrors, perfume, polishes, wallpaper, ribbons, rubber paper, washing powders. Housed soap, and hundreds of other profitable articles. Send no money. Just write a postal for "Member's 20th Century Book of Formulas." Par postman postage and \$1. Popular Mechanics Press, 200 E. Ontario St., Room 802, Chicago.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1050 W. Broad, Richmond, Va.

FORMULAS—Reliable tested formulas for all purposes. Prices reasonable. Empire State Laboratories, 80 Portland St., Boston, Mass.

AGENTS WANTED

AMAZING Invention! World's first 100% automatic faucet type electric water heater. Guaranteed never burn out. Produces hot running water instantly! Fits any faucet. Bakelite, chromium trimmed. \$2.95 retail, you make up to \$1.70. Also automatic immersion, 75c up. Free sample offer. Robinson-Schenkel, Dept. P. M., 215 Fourth Ave., New York.

AMAZING Invention sprays fertilizer and insecticide through any garden hose! Hastens beautiful, healthy growth of lawns, gardens, trees, etc. Eliminates ancient methods. Season at height. Up to \$20 daily easy. Breath taking demonstration. Customers everywhere. Low priced. Huge commissions. Write. Handi-Sprays, Dept. 12, South Road, Ind.

300% PROFIT Selling mystery gas lighter. Retail 25c. Costs you \$1.00 dozen. Sample 10c. Square Deal Mfg., Dept. PM-21, Bradford, Pa.

NATIONALLY Advertised razor blades. Now Collins lets you buy and sell counter cards to merchants at over 100% profit. Others are aspirin—mercuriochrome and 12 more 5c-10c sellers. All on display cards; slide line or full time. Close Collins Chemical Co., Dept. PM-1, Memphis, Tenn.

AGENTS Sell 5 glasses California orange jelly for 25c, double your money, going like hot cakes. Sample 2c. Cutter's Products, 2515 Humboldt, Los Angeles, Calif.

MARVELOUS Chemical cloth, cleans, polishes, all metals instantly without liquid, paste, powder; record-breaking seller to housewives. Stores; 300% profit; sample free. Shef D. Mfg. Co., Union City, N. J.

TIES, New York's fastest seller. "We Want Beer Ties," \$2.25 dozen, 25% with order. World Neckwear, 132 West 34th, New York.

MYSTERIOUS Liquid: Solders, repairs, metal, wood, glass, porcelain, marble, aluminum, without heat. Whirlwind seller. 150% profit. Convincing sample free. Bestwater, 4317M Irving Park, Chicago.

AGENTS For handiwork; original powdered handkerchiefs. Approved Good Housekeeping. Everybody customer. Fine opportunity for hustler. Sample free. Solar Products, J-2143 So. Troy, Chicago.

GENUINE Gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 428-B North Clark, Chicago.

MOST Sensational moth pad deals! Largest, strongest 25c pad ever made—\$11 dozen \$5.00, your profit \$13.00—Hurry! Rhodes Co., EE-2550 North Ashland, Chicago.

100% PROFIT in the Everlasting Match. No hint or friction. What makes it light! No wind can blow it out. Retail 50c. Sample and sales plan 25c. New Method Co., Dept. PM-7, Bradford, Pa.

BIG Profits selling groceries, motor oil, paints, stock minerals. Sample case free. Loversin & Brown, 1642-H So. State, Chicago.

NEW, Profitable—Sell auto step mats. Quality rubber with owner's name molded white. Details free. Rhonite Products, Dept. G-40, 595 Main, Akron, Ohio.

STRANGE Ironing cord. Prevents scorching. Saves electricity. Abolishes kinks, snags. Approved by Good Housekeeping. For telephones also. 100% profit. Samples furnished. Nevechong, Dept. T-A, 4500 Ravenswood, Chicago.

AGENTS Enormous profits! Every auto owner a prospect. Write immediately. Service-Meter Mfg. Company, 1929 McGraw-Hill Ave., St. Louis, Missouri.

500% PROFIT—Gold sign letters. 4 1/2"—\$1.00 per 100. Artists, 121 N. Franklin, Chicago.

REPLATE Brass worn-off automobile parts, reflectors, bath room fixtures, worn spoons, forks, etc., with pure silver. Looks like new. Use U-Kan-Plate Polish. Postcards no necessary; \$1.00 half price. Postpaid. Satisfaction guaranteed. Agents wanted. Dept. A, U-Kan-Plate Co., Philadelphia.

CASH Paid for butterflies, insects. See Sinclair Display Advertisement on page 13.

EASY Money selling 25c needlebooks. Sensational sellers. Cost 5c to 5c. New selling plan for unemployed. Free catalogue. Pats Needles, Dept. P, Somerville, Mass.

500% PROFIT Selling new "24-in-1" kitchen utensil. Retail 25c. Costs you \$1.00 a dozen. Sample 10c. New Method Co., Dept. PM-7, Bradford, Pa.

AGENTS—Distributors—Crew men, New sensation. "Keeps Mosquitoes Away," and coins money. Act quick! Diversified Products Co., Box 576, Toledo, Ohio.

AGENTS—Amazing new patented dish washer! Only \$3.95 complete! Every woman buys on sight! Your commission \$1.50 each sale. Narcon, 1845C Broadway, New York.

FREE: Genuine gold-plated Gillette safety razor, 5 blades and sharpener. Send \$1 for demonstration set and get one set free. Big money to agents. Dept. A, V-H Mfg. Co., 3923 West 6th St., Los Angeles, California.

POLMET Polishing cloth removes tarnish from all metals without the use of liquid, paste or powder. Our agents say it sells like "hot cakes." Retail 25c; sample free. Gale & Co., Inc., 15 Edinboro St., Boston, Massachusetts.

FOLKS Must have household necessities! I'll start you with a regular weekly route supplying famous "Zanol" products to steady customers. Routes pay \$27.50 weekly up. Pay begins immediately. Write Albert Mills, Route Mgr., 1701 Monmouth, Cincinnati, O.

MIRROBS Restored at home. Costs near 5 cents per square foot; you charge 75 cents. Profitable business plating auto parts, reflectors, tableware, silver, refashioning metalware, etc. Details furnished. Details free. Witke, Sprinkle, Plater, 128 Marion, Ind.

MEXICAN Hand made feather pictures. Most artistic, beautiful, attractive. Novelty work. Great margin of profit. Send 25 cents for \$1.00 worth sample and details. Mexican Art, Apartado 1393, Mexico City.

BIG Money at home opportunities. No canvassing. Particulars 10c. Retzel, 802 Garden, Hartford, Conn.

FRUIT Nectar sensation. Concentrates for 6 gallons of grape, cherry, strawberry, orange, port and blue, all for 40c. Every house buys. 100% profit for you. Demonstration sales outfit 50c. Crems Fokke, St. Paul, Minnesota.

400% PROFIT Selling signs used everywhere. Largest selection, wonderful repeat business. \$1.00 worth samples, 25c; 50 signs \$3.00. 100 signs \$5.00. P. Franklin Co., 3122 Third Ave., N. Y.

YOU Can sell Moth Tubs at depression prices—your cost \$4.50 per hundred. Many other low priced year round products. Join in our profit sharing plan. Tennu, 1330-B, Jackson, Chicago.

MANTUFACTURE—Sell your own beverages, extracts, soaps, perfumes, candles, etc. Free booklet. Truvar Laboratories, 1333 Walton St., Chicago.

MEN, Women—Sell Deuel's Ointment. Easy to sell. Good wages. Write Deuel's, Centerville, Michigan.

PORTRAIT And medallion agents! Something new in miniatures and portraits. 200% profit. Old established house. Sure recorders. Juppel Studios, 363 West 15, New York.

SELL Self-threading needles. Over 80% profit. Importer, Dept. M, Myerstown, Pa.

TERRITORIAL Sales rights. Non-competitive necessary, to users of motor vehicles. Saves gasoline, more power, smoother motor, less carbon, proven success. Molgore Generator & Condenser Company, 1633 East 82nd Street, Cleveland, Ohio.

AGENTS—Salesmen. Big profits selling beautiful costume jewelry. Money back guarantee. Arena Novelty Sales, 2000 W. Van Buren St., Chicago, Ill.

100% PROFIT Selling money-making plans. 25c brings sample and particulars. Promote, Box 3, Cleveland, Ohio.

OFFER Four \$1 items by mail. 200% profit. S. Pruitt, Brookfield, Ill.

FAST Mail seller—Free sample. Plans. Circulars furnished. Seawagon, 2323 West 11th, Los Angeles, Calif.

DON'T Fail—Write for newest catalog, new low prices. Koehler's Blue Signs. (Every description) 717 North Fourth, St. Louis, Mo.

SELL Stores carded razor blades, etc. Lomar Products, Albany, N. Y.

ENGRAVED Nameplates, signs, initial plates. Enamel finish. Fire colors, big profit. Hilton Specialty, 90 Stewart, Providence, Rhode Island.

ENGRAVED Name plates, signs, number plates, desk plates, window signs, etc., profits large. Best Bros., Winthrop, Mass.

\$500,000.00 HAS been made in the last ten months by agents selling the Four-Bottle Detroit Sensation. \$3.29 value—sells for \$1.00—costs you 38 1/2c. Write today to Jack Foster, President, American Chemical Company, 1045 St. Anthony Ave., St. Paul, Minnesota, Dept. G.

SELL Sensational razor blade sharpener. Guaranteed for life. Sells on sight. Retail 25c. 100% to 200% profit. Warner Co., C-3875 West 26th St., Chicago. See our display ad on page 119.

BIG Money applying gold initials on automobiles. Fastest thing today. No experience needed. \$1.45 profit every \$1.50 sale. Free samples. "Italco," X-1043 Washington, Boston, Mass.

"SOMETHING Different"—Smart new felt rug. Sample \$1.30 postpaid. Garland Mills, Chelsea, Mass.

PROFITABLE Home business. Legitimate. No canvassing. Maywood Publishers, P-923 Broadway, New York.

GUARANTEED "Run-Proof" hosiery. Men's latest fancy hose—doz, \$1.25-\$1.50; ladies' fashioned hosiery—doz, \$1.00-\$1.25. Catalog free. Superior Hosiery Company, Dept. 34, New Haven, Conn.

NEW Changeable sign sells to stores for \$1.00, agent's profit 300%. Particulars free. National Sign System, St. Louis, Mo.

NEW Discovery. Washes clothes without rubbing. Whirlwind seller. Great repeater. Stomach profit. Sample free. Deaco, 4315E Irving Park, Chicago.

MAKE—Sell these guaranteed, novelty necessities: Plastic wood; evergreen insert sprays; chlorox; hand solder; Silver water paint; fire-saving blankets; Pure tooth tablet; Magic dish wash; Water-Wax floor polish; Master-Compound-liquid marble; using Miller's foremost formulas. Easy to start anywhere, investment small, profits, immediate and great. Dr. Leonard Miller, Chemist, Tampa, Fla.

MAKE—Sell your own products. Formula catalog free. "Kemco," RW, Parkridge, Illinois.

STUCK With your own products. Make-sell them yourself. Formulas, processes, trade-secrets. Analytical service. Catalog free. B. Thaxby Co., Washington, D. C.

BIG Money selling shirts, ties, underwear, dresses, hosiery, raincoats, coveralls, pants, belts, play suits. Sales kit free. Nimrod Co., Dept. 8, 4922-23 Lincoln Ave., Chicago.

THAXLY Formulas produce perfect products. All lines. Catalog free. B. Thaxby Co., Washington, D. C.

FREE "Booklet of money making opportunities," new ideas, original plans, money making secrets and other valuable information. None require peddling or outfit. Elite Co., 214 Grand St., New York.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1950W Broad, Richmond, Va.

BIG Profit putting our genuine gold leaf sign letters on store windows. Experience unnecessary. Samples. Consolidated, 69-T West VanBuren, Chicago.

A BUSINESS or your own—Making sparkling glass name and number plates, checkerboard signs. Big book and sample free. E. Palmer, 512, Wooster, Ohio.

AGENTS—Clerer Invention! Inkapon makes every pen a fountain pen. Fast office seller; big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marul Company, Telhume Bldg., New York, N. Y.

AGENTS Everywhere making money with our line of kitchen specialties, demanded in all homes. Big earnings possible. Write today for details. P. Seed Filter Co., 353 Broadway, New York.

PHOTO Medallion men and women, the latest line of photo novelties in the world. Lowest prices, quickest service. Send for catalog showing over 200 money makers. Gilson Photo Jewelry Co., Inc., 833-837 Grand Ave., Brooklyn, N. Y.

MAN in each town to plate auto parts, reflectors, bathroom fixtures, refinish body, mirrors, chandeliers; by new method. No capital or experience required. Simple plan of manufacturing at home starts you in big money-making business. Outfit furnished. Free particulars and proofs. Gum Metal Co., Ark. H. Deaton, Ill.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1950W Broad, Richmond, Va.

BIG Money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.45. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 40, East Orange, N. J.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name and address, 25c. Stamping outfit, Emblem checks, check-folds, name plates, Hart Mfg. Co., Dept. 2, 303 Degraw St., Brooklyn, N. Y.

AGENTS—Opportunity to make money: book containing 87 successful business plans; home or office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

SOMETHING The housewives want. A signed guarantee to save money and time in cooking. No competition, 400% profit. No license required. Station C. Box 25E, San Diego, Calif.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1850W Broad, Richmond, Va.

CALIFORNIA Perfumed beads, selling like hot cakes. Agents making money. Catalog free. Mission Factory, P. 2324W Pine, Los Angeles, Calif.

WE Start you without a dollar. Soap, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., 641, St. Louis, Mo.

SELL Men's neckwear—wonderful proposition. Astor 34, 38 East 28th, N. Y.

FLAVORING Extracts—Bottle yourself! Labels furnished. 600% profit! Whirlwind money-maker! Repeaters! Free offer. Thomas Manufacturing Company, Indianapolis, Ind.

HIGH-GRADE SALESMEN WANTED

DON'T Be a job hunter—start your own city business on our capital; no hard times, no lay-offs, your own boss; hundreds average \$5,000 annual sales year after year; we supply stocks, equipment on credit; some 250 home necessities; selling experience unnecessary; wonderful opportunity to own pleasure, classified, profitable business backed by \$17,000,000 world-wide industry; for complete information write Raulfich Co., Dept. G-U-2P24, Freeport, Ill.

MEN And women, to follow up regular customers and handle monthly repeat orders on health foods nationally advertised. Everybody a prospect. Highest quality at direct-from-laboratory prices makes easy sales. Everybody in America uses one or more such foods constantly. Absolutely 1932's biggest opportunity. May we mail details? Seedol Laboratories, Dept. 8-1, 27 West 20th St., New York City.

\$18 To \$25 Daily; biggest selling line of men's suits. Meets present day conditions. Amazing values at \$11.95, \$14.95, \$16.95, \$18.95. Also raincoats, slickers, topcoats and boys' suits. Biggest commission paid in advance. Liberal bonus. Free outfit. State age and selling experience. "Jim" Foster, Inc., Dept. 27, 2250 South Spaulding Ave., Chicago.

SALESMEN-DISTRIBUTORS. New auto tire patch; guaranteed 10,000 miles. Repairs blowouts permanently. Sells garages, car stations, tire shops. Salesmen's profit 100%. Up to 300% to dealers. Easy seller. Exclusive territory. Economy Rubber, 832 Burkhardt, Darton, Ohio.

APLENTY New and different—Fast selling 5c and 10c merchandise on attractive counter cards. 100% comm. for you and dealers. Advertised by Radio. No investment required. Catalog free. (Estab. 1921.) World's Products, 250 Central, Spencer, Ind.

BUILD Up a business of your own, part or full time, selling nationally known name-brand necessities. Quality products. Write today for territories and particulars. Tourist Trade Mfg. Company, E-7, Minneapolis, Minnesota.

SALESMEN Calling on merchants can add \$10-\$15 daily to their present income. Wonderful salaries. Experience unnecessary. Complete pocket outfit free. Universal, AD Jackson, Chicago.

\$15.00 DAILY Selling union label business stationery \$2.75 thousand. Business and three color blotter cards \$1.50 per thousand. Free out service. Big commission. Large outfit. National, 108 No. Jefferson, Chicago.

SALESMEN: Everybody buys business stationery; largest line; highest quality; quickest delivery; biggest commission. Free cars. Experience unnecessary. Outfit free. Lunell, Dept. 11, 312 So. Hamilton, Chicago.

MILLION Auto safety signals sold abroad. Now introduced here. Illuminated. Fits any car. Big money-maker. Red Flash, 6221 South Damen, Chicago.

SALESMEN—Something new! Wood powders, turn into wood. Strongest repair known. Plastic rubber, no heat used, repairs tires, tubes. Tarnish Products Co., South Hill, Virginia.

200 SALESMEN—Motor-Pen superior spark plugs. 117 Harrison, Chicago.

OUR Latest sensational pin game amusement machines and punchboard specialties practically sell themselves. Big commissions. Lincoln Sales Company, 116 So. Wells, Chicago, Dept. D.

SALESMEN With following among garages, filling stations, and tire trades. Write for complete information. Article new, fully guaranteed. \$60.00 per week easily possible. No investment required. Columbia Fabelo Co., 107 Broadway, Boston, Mass.

SELL The original Vino Sano wine juice brick, the only genuine California product, all flavors, port, cherry, claret, burgundy, etc.; legality tested in courts; 100% profit chances. Free samples and travel allowance to proven producers. Write: Vino Sano Co., Dept. 8-264, San Francisco, Calif.

\$30 DAILY. Newest trade booster featuring \$12.50 electric lamp clock for \$2.99. Merchants guaranteed results or money refunded. Stimulators, Dept. 10H, 4311 Ravenswood, Chicago.

\$50.00 DAILY Easily made selling latest coin operating pin game on seven days' trial. Legal everywhere. Stimulators Corp., Dept. 1-S, 4311 Ravenswood, Chicago.

CAN You sell beautiful 3 place quality toilet set including pair superb brushes for \$1.00? Paris Laboratories, 3143 Locust Blvd., St. Louis, Mo.

BIG Money maker for stores reaping handsome profits. Financed amusement machines. Sell something that's really selling. Ad-Loc Company, Dept. 53, Chicago.

FINEST Business-selling advertising novelty known. Imported, absolutely new and unique, very low price, sells itself. Sure repeater. Liberal commissions, exclusive territories. All states open. Samples free. P. O. Box 740, Buffalo, N. Y.

UNFERMENTED Grape Juices, flavors: cherry, port, champagne, etc. Low prices, big profits. Enfergrape Co., Huntington, West Virginia.

SALESMEN—Make \$10 weekly. Sell garage, filling-station workers our patented non-skid \$2.98 work shoe. Free sample. Astill Shoes, 1050 West Newton, Mass.

SCREW-HOLDING Screw drivers! Not magnetic. Remove, insert screws. Factories, garages, carpenters, electricians, mechanics, radio owners buy. No competition. Miller, 5029 Winthrop Bldg., Boston.

SALESMEN—Distributors. Sell "Bromo-Kola" syrup to soda-fountains and bottlers. Diehl Beverage Company, Memphis, Tenn.

SALESMEN—Four \$15.00 sales to stores net you \$10.00 daily. Sagers Systems, Est. 1895, 7301-723 Sheffield Ave., Chicago, Ill.

EXPERIENCED Salesmen. Wonderful opportunity selling full line accident and health policies. Sell easy. Liberal commissions. Twenty-four-year-old local reserve company. Write for special offer, Inter-State Business Men's Accident Co., Dept. 18, Des Moines, Iowa.

GIVE Profits—Up to \$179 weekly. \$500,000 punchboard firm announces new no investment plan. Season starting. K&S, 4326 Ravenswood, Chicago.

FREE Booklet describes 87 plans for making \$20-\$100 weekly in home or office back-overs of your own. Elite Co., 214 Grand St., New York.

SELL Carded razor blades, aspirin, violet breath gum, chewing lozenges, polishing cloths, shoe lacers, handkerchiefs, rubber goods, etc. Large line. Big repeat profits. Attractive displays. Superba Company, 8203, Baltimore, Md.

BIG Profit outfit on genuine gold leaf sign letters on store windows. Experience unnecessary. Samples. Consolidated, 69-Y West Vanhook, Chicago.

WONDERFUL Opportunity. Twenty dollars per day can be earned. Experience unnecessary. Home protection at cost. Ages one to eighty. \$250 to \$1000 at death. Not insurance. You make \$5 for each member secured. Children, of Virginia, sent in 54 one day. National Aid Society, Myers Building, Springfield, Illinois.

SALESMEN—Become independent. Own your business; experience unnecessary. Selling our \$20,000 accidental death; \$50 accident; \$25 sick weekly benefits—\$10.00 yearly. Other amounts proportionate. Guaranteed steady income from renewals. \$250,000 designated insurance department. Universal Policy, Dept. A, 716 Lefcourt Bldg., Newark, N. J.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$180 weekly. Forer cleared \$4920 in three months. Write, P. E. Armstrong, President, Dept. PM, Mobile, Ala.

HELP WANTED

IF You want to get your groceries and household supplies at wholesale, and a wonderful chance to make \$15 cash profit a day besides, send me your name immediately. No experience necessary. Albert Mills, 1792 Monmouth, Cincinnati, O.

WANTED: Wood pattern-maker, foreman or superintendent for special service in his own city. Write, Lock Box 42, Manitowish, Wisconsin.

AMAZING New electric trouser neesser good for \$25 daily; puts razor edge in pants in 10 seconds, sells for \$2.50; your commission \$1.00. Sample fits pocket. Munny Mfg. Co., Dept. C-8-G, 817 Main St., Cincinnati, Ohio.

AGENTS—Mass corn and callous remover will build you a steady repeat business. Send today for pocket-size trial outfit. The Moss Company, 201 Searle Bldg., Rochester, N. Y.

CASH Paid for butterflies, insects. See Standard Display Advertisements on page 14.

EDUCATIONAL AND INSTRUCTION

REFRIGERATION. Today's great industry, needs experts everywhere; learn practical service. Installation, overhauling, theory. Short course. Bulletin P380 free. Herkimer Institute of Refrigeration, 1819 Broadway, New York City.

LEARN Commercial portrait, motion picture photography. Home or resident instruction. Catalog free. New York Institute of Photography, Dept. 49A, 10 West 33d St., New York.

WORK For "Uncle Sam." \$105.00-\$250.00 month. Life jobs. Pleasant work. Paid vacation. Men-women, 18-30. Common education usually sufficient. Experience unnecessary. List positions and full particulars—free. Don't wait. Write today sure. Franklin Institute, Dept. T3, Rochester, N. Y.

MEN, Women, we train by mail for positions in Southern winter hotels. Leo Hotel Institute, Dept. 17, Drawer 1706, Boston.

WANTED. Men-Women, 18-50, qualify for steady Government jobs. Salary range, \$105-\$250 monthly. No Government experience required. Paid vacations. Commensurate. Thousands appointed yearly. Write Oxnard Institute, 181, St. Louis, Mo., immediately.

LEARN Photo-engraving at home by experience. Equipment furnished. Earn while learning. Aurora Photo-Engraving School, Aurora, Mo.

BECOME A landscape architect. Un-crowded profession; wonderful opportunity for money-making. Easily mastered by mail. Earn while you learn. Est. 1916. Write for details, American Landscape School, 7 Pimouth Bldg., Des Moines, Ia.

PHOTOPLAY Talking picture and magazine stories wanted for revision, development and copyright. Sell on commission. Established 1917. Booklet free. Universal Scenario Company, 405 Meyer Bldg., Western and Sierra Vista, Hollywood, Calif.

U. S. GOVERNMENT Wants men, \$1,200-\$1,500 and up at start. Railway mail clerk examination coming. Let our expert (former government examiner) prepare you for this and also rural carrier, post office, customs, internal revenue, and other branches. Write today for free booklet. Dept. 8, Patterson School, Rochester, N. Y.

DON'T Prepare for any civil service examination without seeing our catalog. Free. Columbia Correspondence College, Washington, D. C.

MECHANICAL Models, new and novel. Everyone is familiar with the "anatomical chart" method of teaching the physiology of the human body. Popular Mechanics has developed similar accurate models in the mechanical field. Models now ready are Wright "Whirlwind" 300 Engine and Ocean Liner "Europa." Others to follow. Every part clearly shown and the name given. Invaluable to students and all who are mechanical is limited. Price \$1.00 each. Sent postpaid anywhere upon receipt of price. Popular Mechanics Press, Room 804, 230 E. Ontario St., Chicago.

SHORT STORIES

SHORT Stories revised, typewritten and marketed. Details free. Hurst Service, Box P-1013, Harrisburg, Penna.

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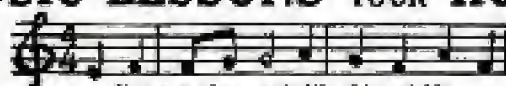
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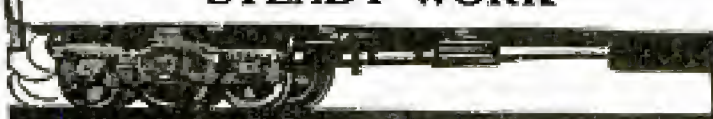
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RUBBER tires, which have carried vehicles over the highways since the horse-and-buggy days, now are being applied to the railroads through the recent development of rubber-tired rail coaches, each equipped with its own self-contained power plant. These cars are really motor coaches on rails, although they have some of the qualities of the locomotive, automobile and airplane. They are light in weight and can be operated economically, as a small four-cylinder engine drives one of the coaches at express-train speed. The

operator of such a vehicle performs some of the duties of an engineer, chauffeur, motorman and conductor.

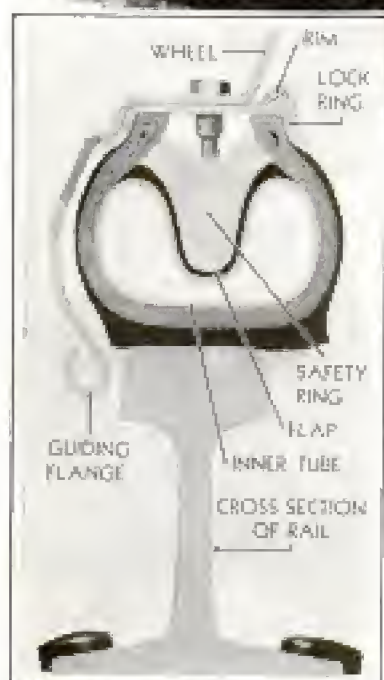
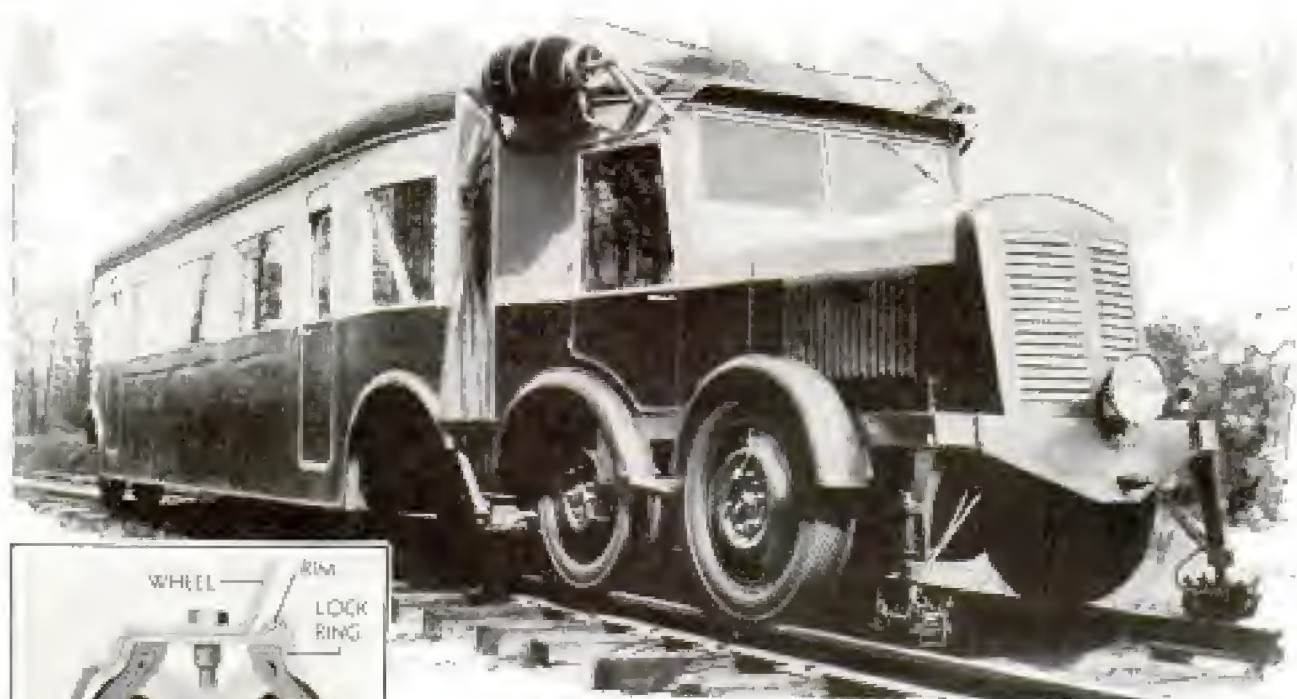
This transformation in railroading traditions started when J. Hauvette Michelin, French inventor and tire manufacturer, developed a rubber-tired railway coach that, for smoothness of running and overall efficiency, surpasses any other land vehicle. Already these coaches have been put into use, on regular schedules, in America, and their general adoption, particularly for short runs, is apparently a

Cmd. Waller

Edward S. Budd Mfg. Co, Budd's Michelin Rail Car Slip 25th and Hunting Park Phila

High Commercial

03-849
2
Goodyear Tire & Rubber Co Akron, Ohio



matter only of time. And so we find seasoned railroad men who used to look with contempt on the automobile now talking about getting ten miles to the gallon, and about keeping the tire pressure up to eighty-five pounds.

But these are only a few of the changes that the rubber-wheeled train is introducing. The train itself displays a number of devices that make a self-respecting steam locomotive wear out its safety valve. For instance, there is the car itself, a streamlined, stainless-steel forty-passenger coach weighing only 11,000 pounds, a mere feather in comparison with the 150,000-pound figure for a standard Pullman. And such a coach is driven by a little four-cylinder automobile-type motor, rated at less than twenty horsepower, that would be lost in the fire box of a switch engine.

This motor is cooled by two odd-looking devices sticking out, like horns, from each side of the cab. These are aviation-type radiators, borrowed intact from the airplane. They are successful where the ordinary automobile radiator failed because, being out in the open, they are equally efficient whether the train is going forward or backward.

The new train has a pair of feelers in the form of metal brushes which sweep along the rails ahead of the leading pair of wheels. Although they look as if they were put there to remove tacks, glass and stones—which they do, incidentally—they really are electrical contacts for operating train-signal devices.



Top, the Rubber-Tired Car; Center, Cross Section of Rail and Tire; Below, Metal Brush for Automatic Signal Devices

B. 828. Royce Stetson
Jumper, at United
Airport³
Berkeley
Calif

When a tire develops a leak, and the pressure falls too far below the eighty-five-pound mark, a horn blows in the control cab. The driver reads the pressure gauges attached to the wheels, until he finds the guilty tire. A wood ring inside the tire prevents it from going so flat that the steel flange, which keeps the wheel on the rail, will strike ties or become jammed in switches.

The new kind of train may be a means of recovering much railroad business that has been lost to automobiles. A ten-wheeled coach, seating twenty-four passengers and carrying baggage, can travel sixty miles an hour and get ten miles to a gallon of gasoline.

B. 741

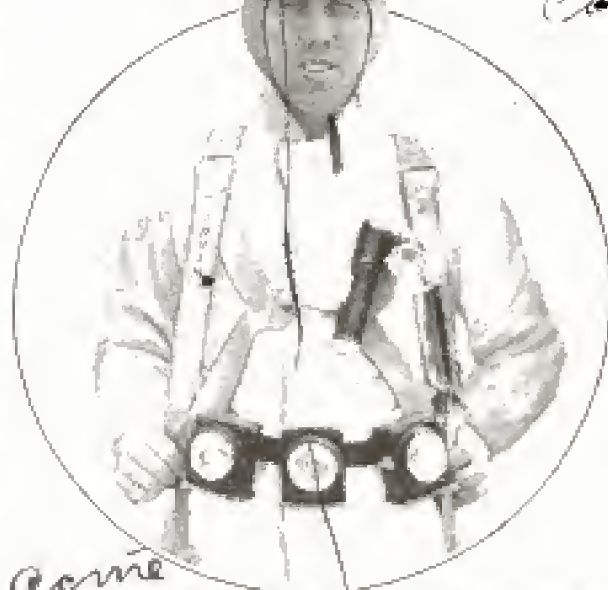
BABY ELEPHANT BREAKS A LEG AND DOCTORS GET BIG JOB

"Zoohu," a 350-pound baby elephant at Atlantic City, had the stomach ache and among the medicines prescribed was a pint of whisky. This cured the colic, but the baby fell and broke a front leg—an accident caused by weakness from his long fast, according to trainers. The fractured limb presented a problem in engineering for the doctors. To repair the damage, it was necessary to hoist the elephant in a swing attached to block and tackle, then set the leg in splints wrapped with yards of tape and supported by many pounds of cotton.

Baby Elephant in a Swing, with Broken Leg Swathed in Bandages



at Steel Pier
Atlantic City, N.J.



Come
Parachute Jumper Wearing a Harness Equipped with Flashlights to Aid Him in Leaps at Night

FLASHLIGHTS FOR PARACHUTE ILLUMINATE NIGHT JUMPS

Leaps from airplanes at night are being attempted with the aid of parachutes equipped with flashlights. As the jumper leaves the plane, a powerful parachute flare is dropped from the craft. This lights up the ground and enables him to select the best spot for descending. Spotlights are attached to the harness of the parachute to enable the jumper to obtain additional illumination as he nears the ground. In the first tests, a powerful search light was also focused on the jumper as he descended.

NEW MAGNETIC ALLOY IS STRONGER THAN STEEL

Japan has recently developed a new magnetic alloy composed of nickel, steel and aluminum, which is said to have many superior qualities. It is reported to have twice the magnetic strength of the most popular form of magnetic steel, costs only one-fifth as much, weighs twenty per cent less and is more durable. It has been patented in most of the larger countries, including the United States.

cont. Roger
Lawrence,
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D.C.

must be proper Relation
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know. The high
miching of the
B. 925



Workmen Are Shown Atop High Cable Tower; Note How Small Those Fishing Vessels in the River Appear from This Point

POWER-CABLE MASTS TOWER TWO HUNDRED FIFTY FEET

Towers 250 feet high support power cables carrying 132,000 volts where England's great overhead electric supply line crosses the river Yare. A transformer station for stepping down the current to suitable voltages is located at Great Yarmouth. Hook ladders are used by men working on the slender girders of the huge towers.

SHOOTING STARS' TRAIL SHOWS DIRECTION OF WINDS

Bright trails of meteors, or shooting stars, tell scientists the direction and speed of winds in the high atmosphere, miles above the earth, and data thus obtained are valuable in the understanding of the behavior of radio waves. Dr. E. O. Hul-

burt, of the Naval Research laboratory, points out that amateur star watchers as well as professional astronomers can help fill in the gap that still exists in our knowledge of these phenomena. Observations thus far obtained indicate that the winds at levels from somewhat under twenty to about fifty miles blow toward the west, during daylight hours at least. Meteor trails observed at night have been at higher levels and showed winds blowing in opposite directions from fifty to eighty miles high. Some trails indicated cross currents, eddies or calms in the upper reaches. To make such observations, a telescope that can be maneuvered quickly is required.

SCREWDRIVER HAS OFFSET BLADES

Screws in tight corners can be turned with a tool that has an offset blade set at an angle of forty-five degrees to the handle. The tool is a steel rod, the blade forming a shape like a letter "T." The other end of the handle is flattened for driving screws. Made of chrome-molybdenum, the screwdriver has remarkable strength. One size of the tool is designed especially for working slotted-head bolts on automobile steering-gear boxes.



This Screwdriver Reaches Into Corners: One End Is Turned at 45-Degree Angle to Make Work Easier

Cornwall Quality Tool Co.
Mogador, Ohio

Central Electricity Board
England

may be

609 1/2 in. 609 1/2 in.

Copyrighted material

Flying Tank

Newest Air Menace



SCORES of big airplanes roar majestically over enemy territory without firing a shot or dropping a bomb; they swoop suddenly to earth, then zoom into the air again, leaving on the ground the queer shaped cockpits they had been carrying. The grounded cockpits, veritable small fortresses, move forward, seventy-five, then eighty-five miles an hour, spitting death and destruction from machine guns. One hundred flying tanks, manned by just 200 men, would rout an army of several thousand.

Such is the purpose of the flying tank. Behind closely guarded doors—J. Walter Christie, inventor of many engines of war adopted by the United States government, has already assembled this squat and shiny engine of destruction and subjected it to tests so satisfactorily completed that a foreign power has offered an enormous sum for the plans, and U. S. army officers

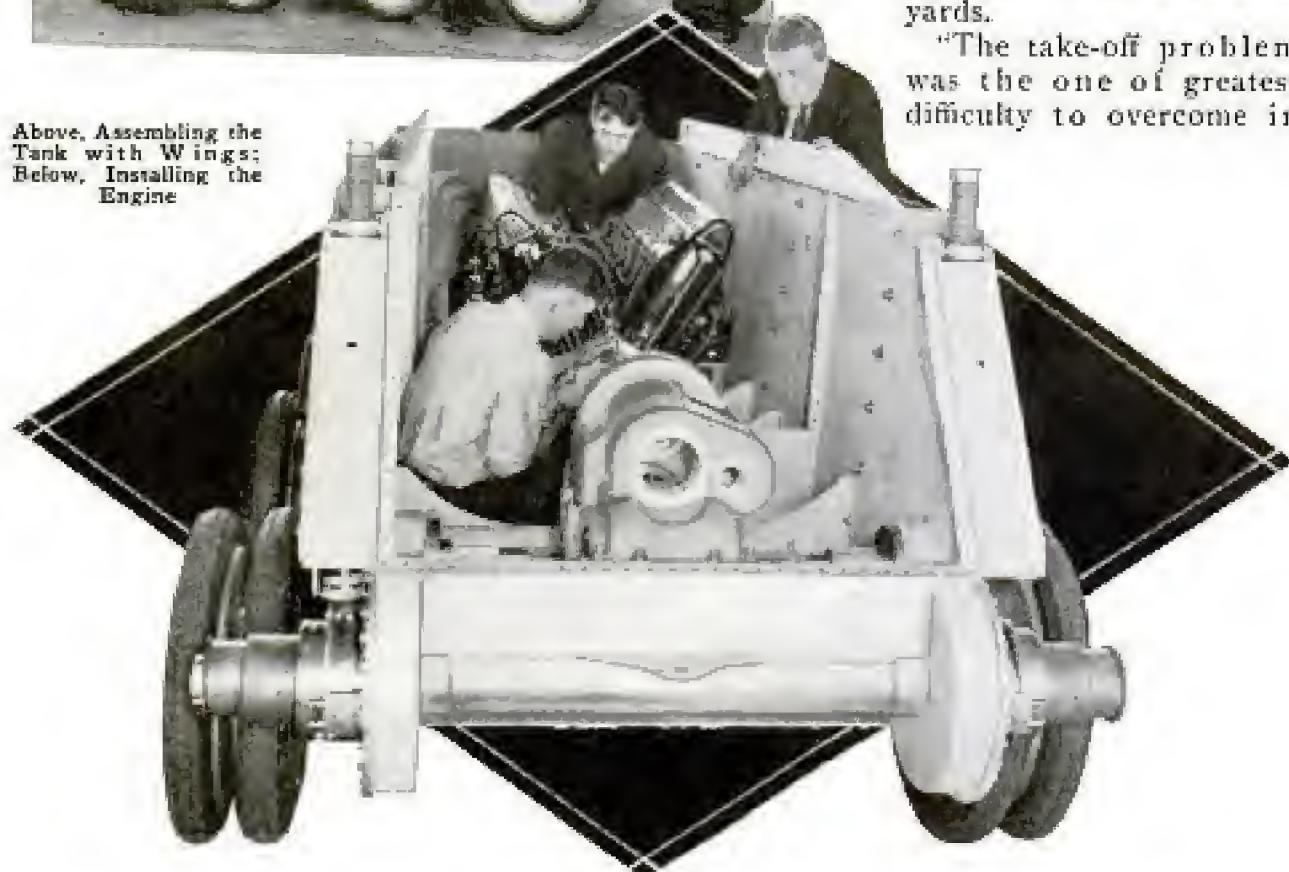


Front View of the Flying Tank Which Will Be Carried beneath a Powerful Bombing Plane

*C/o United States Wheel Track Layer Co.
Linden, N.J.*



Above, Assembling the Tank with Wings;
Below, Installing the Engine



its driving wheels gather so much momentum within the first eighty to ninety yards that when the power is transferred to the propeller, the tank will go into the air within a hundred yards.

"The take-off problem was the one of greatest difficulty to overcome in

are eagerly waiting to make final tests.

Small, compact, grim and ugly, the Christie tank weighs 11,000 pounds. It is so designed that it may be the fuselage of a plane whose wings are released when the tank touches the ground and goes into action, or carried by large planes and released instead of bombs. The machine has springs that allow each pair of the six wheels to rise over a bump in the ground independently of the body of the tank, which may continue to travel on the other wheels, covered by their endless track. Slots cut in the undersides above the axles make possible this high degree of give of each pair of wheels.

A 750-horsepower engine furnishes the motive power of the tank, and the inventor has installed it as a dual-purpose motor. It may either be used to drive the tank forward or turn the propeller for flying. Mr. Christie has so designed this phase that, when a flying tank takes off,

making an efficient flying tank," he said. "Yet the light weight of the tank has been instrumental in solving it. So much so that I have incorporated a monoplane instead of a biplane design. What is more, the pilot of a flying tank does not need the level ground required by a bombing plane to take off. He can take off through mud, through bumpy ground and ground which would prevent the average plane from rising."

In landing the tank, the pilot will be equipped with special air and land-speed indicators. Coming down in a glide, he notes his air speed, transfers the power of his motor to his tank wheels, and when he notes their speed on his indicator, he lands the tank and either shoots forward to charge the enemy, dropping his wings by pushing a single lever, or slows it and stops within a remarkably short space by using the treads as a brake.

In cases where the tank is carried under

Christie - Suiza

big bombing planes, dual speed indicators are connected up in the flying tank proper and in the pilot's cockpit so that the tank operator knows just how fast to speed up his motor when the bomber deposits him on the ground.

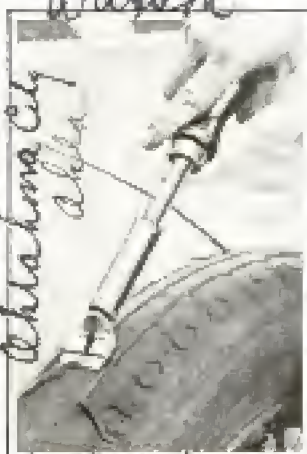
Independent of the three sets of pneumatic-tired wheels over which runs the tread, Mr. Christie has mounted two small sets of wheels, one fore and one aft, so that the tank may negotiate shell holes and trenches with the same facility as its big, cumbersome brother.

GREAT UNKNOWN MAYAN CITY FOUND IN YUCATAN

Ruins of a great unknown Mayan city have been found in southern Yucatan. More monuments are found in these ruins than in any city of the Mayas ever explored by white men. The ruins were discovered by an American botanist, C. L. Lundell, and were examined by Dr. Sylvanus Morley of the Carnegie Institution. The city, called by the discoverer, Calakmul, meaning "the two adjacent hills," obviously was once a great religious center. Many recorded dates, sculptured on stone markers, or stelæ, are expected to give new clues to the early history of the Maya Indians.

OLD TIRES RETREADED ON CAR WITH HAND TOOL

Automobile tires that are worn smooth can be retreaded with a hand-operated heating tool now on the market. Ordinarily, used tires have enough rubber over the fabric to allow for the cutting of new treads. The tool, with a heating element like a soldering iron, has removable points or gouges of different depths. When the iron is hot, the gouge is run along the tread, tracing any design. There is no danger of burning or charring the rubber, it is claimed.



© Harris & Ewing
Apparatus for Sealing Pores in Eggs; Freshness Is Retained over Long Periods by This Means

EGGS STAY FRESH IN VACUUM AFTER SEALING PORES

Discovery of a method to seal the pores of eggs so they will retain most of their qualities of freshness has been made after prolonged study by the department of agriculture. Fresh eggs that have been dipped in oil and subjected to carbon-dioxide gas, in a vacuum chamber from which other gases have been dispelled, will retain practically all their original moisture and carbon-dioxide content. It is the partial loss of these two elements that causes deterioration in cold storage, it was found.

ELECTRIC "EYE" TURNS ON FANS IN HOLLAND TUNNEL

Electric "eyes," or photo-electric cells, which count the vehicles passing through the Holland tunnel in New York have been given another task, that of turning on the ventilating fans. They have been connected to mechanical and electrical apparatus which control smoke conditions, and whenever the haze becomes too thick, the ventilators are started automatically instead of being pretimed.

Capt. Charles A. Whitehouse
c/o Holtzer-Cabot Electric Co.
125 Amory St. Boston
Mass

Science & Service Wire 4/30/32

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Bureau of Chemistry and Soil
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Akron, Ohio

\$18.50

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W. Watson Co. Main and
Cedar Sts.
Akron, Ohio

BUILDING with



Section of Travel and Transport Building Whose Flowing Lines and Angles Lend Themselves Readily to Illuminating Effects

By H. W. MAGEE

IT is night. A tower of sparkling jewels points to an indigo sky in which float green and crimson clouds that suddenly become pink and yellow. Trees and shrub-

One of the World's Fair Buildings Whose Tower Will Blaze with Lights



bery emit a luminous glow, while a bed of purple tulips changes to red and then to orange. Geysers in rainbow hues spout from a lagoon whose rippling waters dance with iridescent lights.

Down the horseshoe facade of a glittering palace cascades a miniature Niagara with foam and spray tinted in delicate pastel shades. The walls of near-by buildings shimmer like the reflection of the sun's rays on water or change gradually as one color merges into another. Overhead the powerful beams of giant searchlights criss-cross to pick out airplanes that stand for a moment in bold relief and then are lost in the night.

This is not a child's dream of fairyland, but the scene which will unfold itself before night visitors to Chicago's Century of Progress next summer. It represents the wizardry of the illuminating engineer who will build with beams of colored, moving lights a gorgeous city of flaming rainbows whose ever-changing hues are calculated to astonish and awe the beholder.

To transform this World's Fair by night

LIGHT

into a panorama of color, lighting engineers plan to utilize 10,500,000 candlepower. Translated into terms of electrical energy, this represents 13,500 horsepower or 10,000 kilowatts. In the course of one evening, the lighting effects for the fair will consume enough



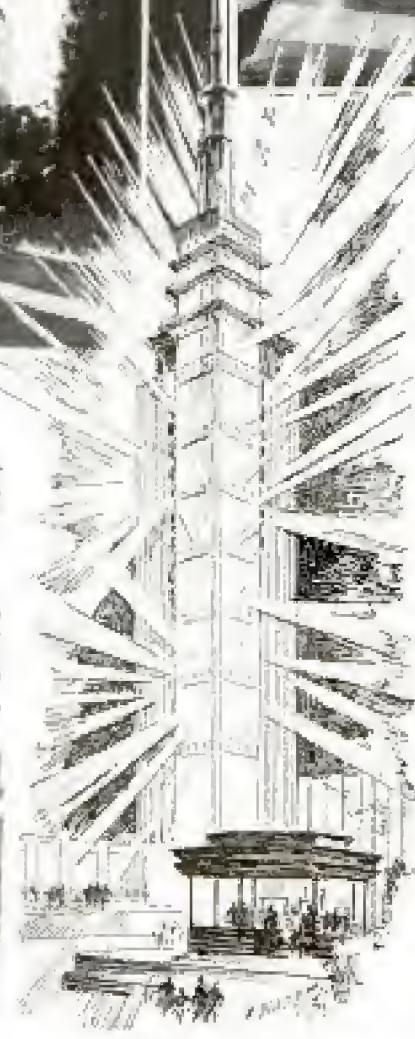
Interior View of Exhibition Hall
Where Aluminum Has Been Used
Liberal for Ornamentation



Modernistic Lines of
Main Facade of Ad-
ministration Building

electricity to supply the normal needs of a city of 40,000 persons.

Edwin D. Tillson, illuminating engineer for the Fair, points out that the Chicago



exposition will be unique in that it has been built from the ground up with the illumination idea always paramount. No building is being constructed, and not even a tree or piece of statuary is being placed, until lighting experts have planned just how to illuminate it effectively. No item, not even a bit of shrubbery, is too small to lend itself to the lighting plan.

As a result, remarkable color effects are to be produced. Flood-lighting, as commonly conceived, will be conspicuous by its absence. Instead, virtually all exterior illumination will be in color, these being chosen to embellish the rich shades of paint that enhance these modernistic structures by day. One novelty will be shimmering effects on walls like those produced by the reflection of the sun's rays from water. These action patterns are



An Unusual View of the Travel and Transport Building, Looking Straight Up from the Base; Note the Symmetry of Lines

to be produced by a light projector that plays on water as it is agitated to provide the fantastic moving colors on the walls.

Scintillators likewise are to be employed. These are nothing more than squares of polished metal trembling on delicate supports to flash dancing patterns over large areas of frosted glass. This is one of the few effects that can be utilized by day when the sun's rays will be allowed to penetrate the glass at many points, the rays being reflected back by the metal squares like the heliograph used by the army for signal purposes.

The sky above will likewise lend itself to decoration. Because fogs are usually absent in Chicago in summer, illuminating engineers will create their own vapor by releasing chemicals from airplanes at an altitude of 1,000 feet. As the clouds settle

earthward they will be illuminated by searchlights in a manner like that used at Niagara falls where clouds of water vapor are tinted.

A high light of the Fair will be the tower of the Hall of Science which will be ablaze with electric jewels. These jewels, studded solidly about the top, are only small and inexpensive projectors, each throwing a high-candlepower beam emanating from a comparatively weak source of light. At a distance of 300 yards or more, these jewels merge into a blaze of light and color, easily visible for many miles.

Another brilliant effect is to be obtained in a manner equally simple. Large areas of bright, corrugated metal cover the walls, and these are to be illuminated by concealed sources. Towers, thus lighted, seem to be composed of hundreds of bright, horizontal color lines, one hue alternating with another.

A high light of the night display will be a flaming ladder arc, using a potential of 33,000 volts, which will form the axis of the circular court of the electrical building. The base is a huge outdoor transformer. Rising from it will be two electrodes, thirty feet high. A flaming arc starts from the bottom of these electrodes and travels upward. As the intense flame dissipates at the top, another automatically forms at the bottom, so there is a succession of these fiery bridges or rungs from which the spectacle takes its name. As these arcs with their circular halos move upward, dry chemical salts are injected by compressed air to impart beautiful changing colors to the arc stream.

As a background for this display, there will be a spectacular series of cascades flowing down the semicircular facade of



Proposed Design for a Tower of Water as High as a Skyscraper; Water Would Flow over Decorative Surfaces of Glass and Concrete, Rich in Color, and Would Be Illuminated by Night

the great court. Seven of these cascades drop from one ledge to another, giving the appearance of a miniature Niagara, and as the water falls, it is to be illuminated in rainbow colors by concealed lights.

Trees and shrubbery will be illuminated in autumnal colors by means of lamps concealed in flowerpots and lashed to the bases or among the branches. Inserted in the pots will be trailing vines to create a more natural appearance. Flowerbeds likewise will be treated with serpentine patterns in light, close to the ground. Fluorescence will be used to strike a mystic note. Many objects, such as flowers, foliage and statuary, are to be treated with fluorescent materials and under the so-called invisible light will appear in startling contrast to their surroundings.

Daytime visitors will observe what appear to be floating islands in the lagoons, covered with water reeds and foliage. These are decoys and will conceal powerful electric pumps, jets and lighting pro-

jectors. At night, these innocent-appearing islands will form the basis of tremendous geysers, beautifully tinted with changing colors, to produce fixed and twisting patterns and form buttresses, arches, columns and spirals. By altering the locations of these islands, the over-all aspect of the display can be changed overnight. Fluorescent fountains, which emit a mysterious glow to the water under invisible light, will also form a part of the water display.

Interior illumination of buildings will be almost as unusual as the exterior effects. These modernistic structures are virtually without windows and will be lighted both day and night by electricity. Like the buildings themselves, the lighting fixtures are temporary, and display booths will be illuminated with units that clip to the ceiling in a few seconds and can be removed as quickly.

The great halls, rotundas and galleries will be embellished with large luminous



Tower of Hall of Science, Which Will Be Studded with Jeweled Lights at Night; Carillons Will Sound from the Top

panels of colored fabric, glass and reflecting metal. As a result, there will be few lighting fixtures, as the term is generally understood. Some rooms will be illuminated from sources entirely concealed. The light will come from tiny openings in walls and ceilings because it has been found possible to force a tremendous amount of light through even a pinhole.

Neon lighting is to be liberally employed, but not in the rather garish man-

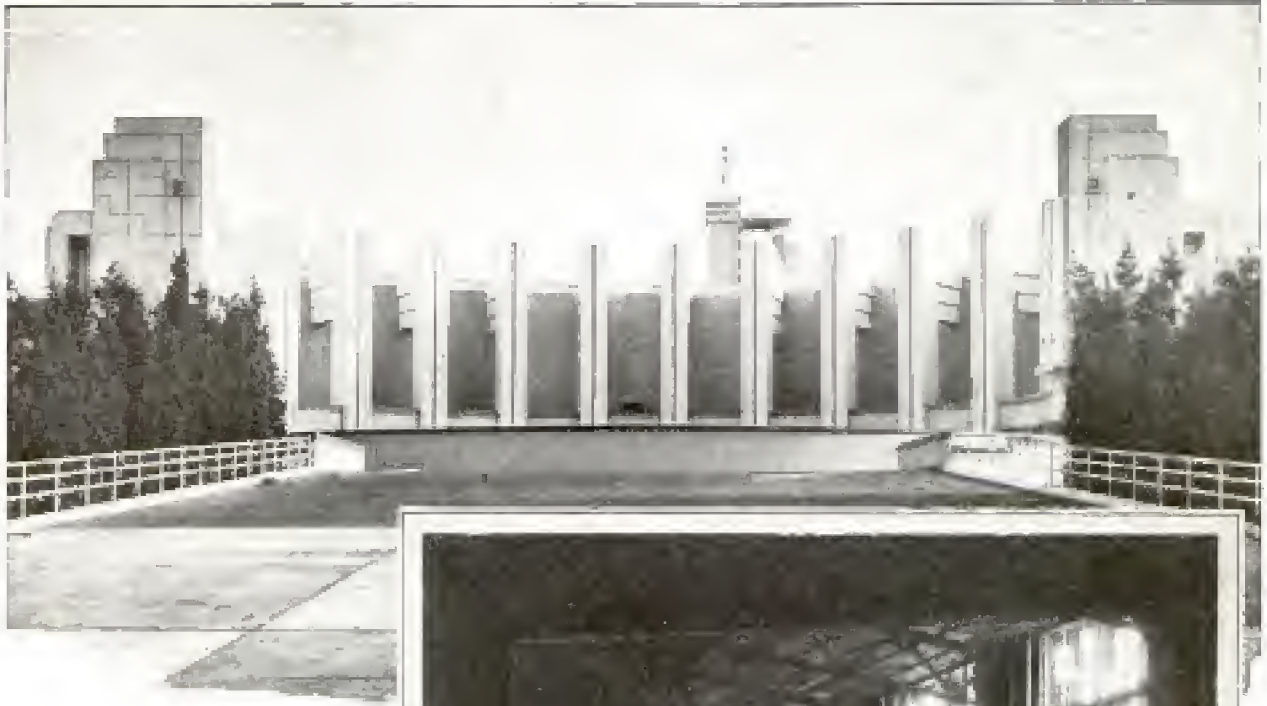
ner associated with such a display. The tubes will be concealed behind grills and metallic planes, to give the rich glow of this type of light without the sharp, raw effects. In other cases, overlapping silhouettes or grills will be used to heighten the illusion of texture and depth.

For instance, the great hall of one building will be lighted with metallic jewels strung along the underside of radiating ceiling beams. Concealed behind a ceiling panel, at the hub of this design, will be a series of slowly rotating light projectors, the beams from which will strike the jewels in expanding fashion, those near the hub picking up the light first, then those farther removed, so that there is a constantly radiating action from the center. At the entrance to the hall will be a colored-light pattern emblazoned on the floor, apparently in colored tile, but actually by light projection from the ceiling above.

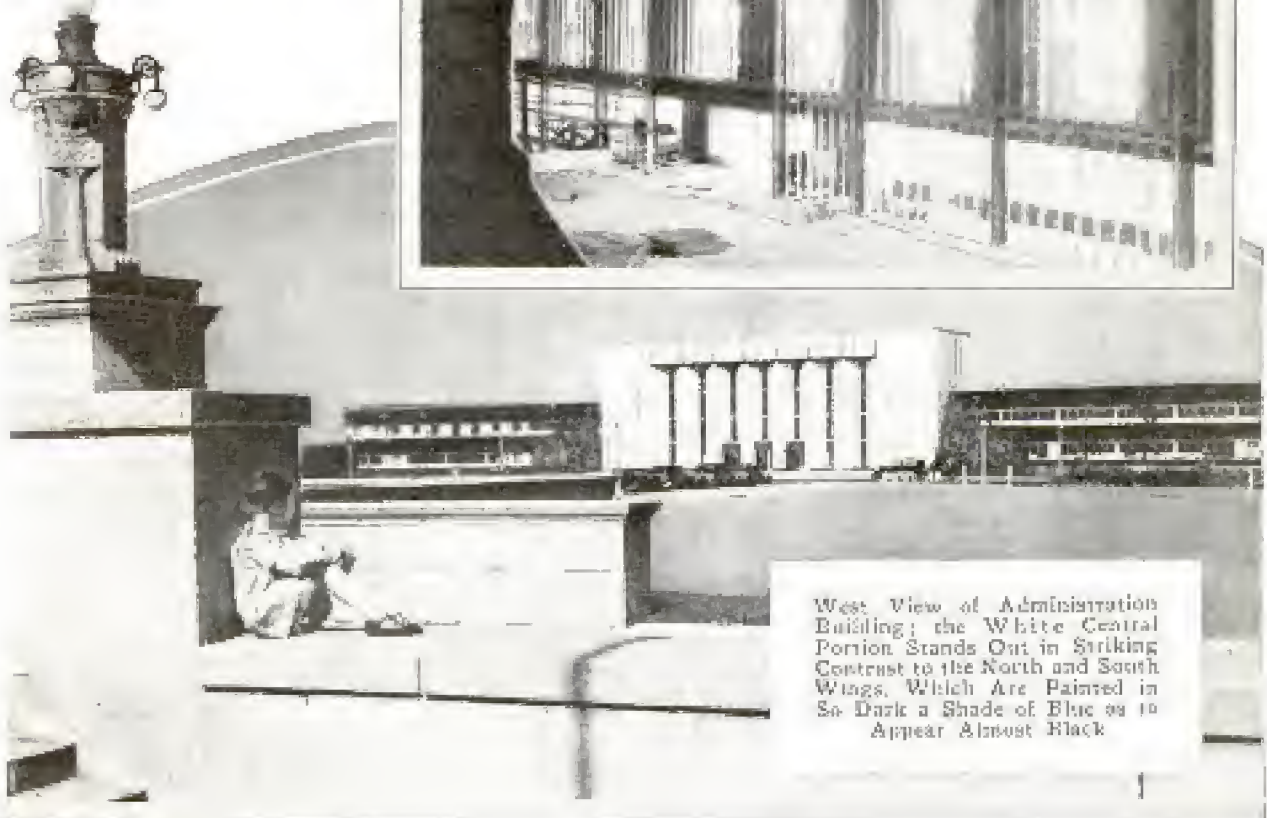
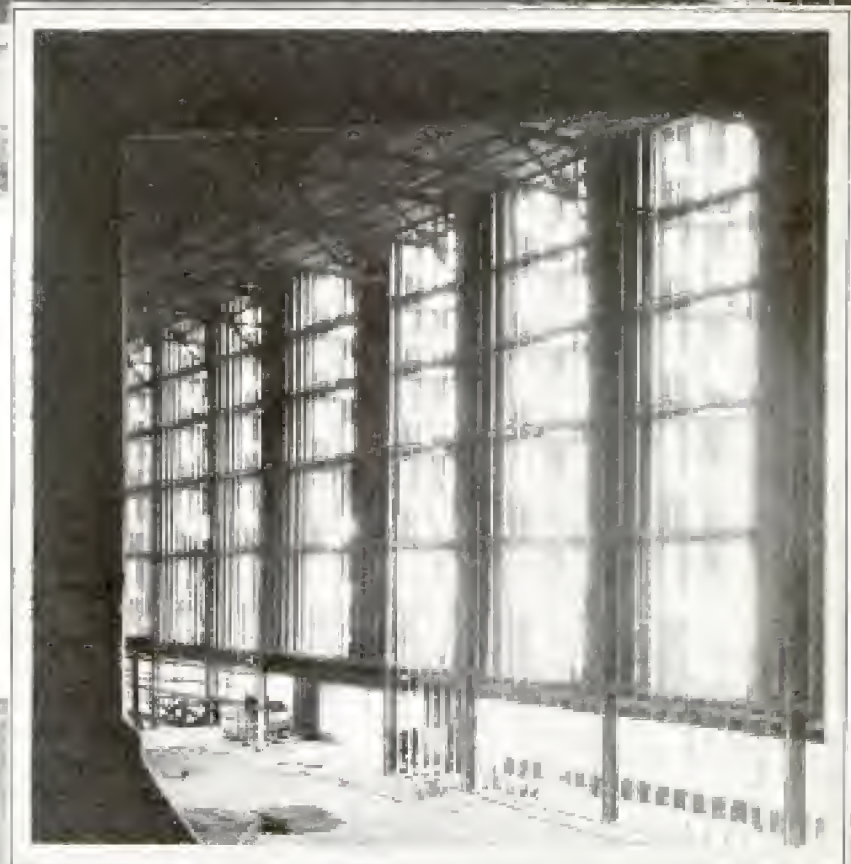
While the entire Fair is being planned with the idea of offering a gorgeous scene by night, the daytime effects for this very reason will be unusual. To provide for illuminating effects, many

of the buildings have been painted in rich colors and others have been decorated in startling designs that lend an even more modern touch to the modernistic architecture.

The use of such a vast amount of electric energy, paints and other materials exclusively for illumination purposes is a costly procedure in itself, but actually it has been found that decorative lighting will be a real economy. The reason is that

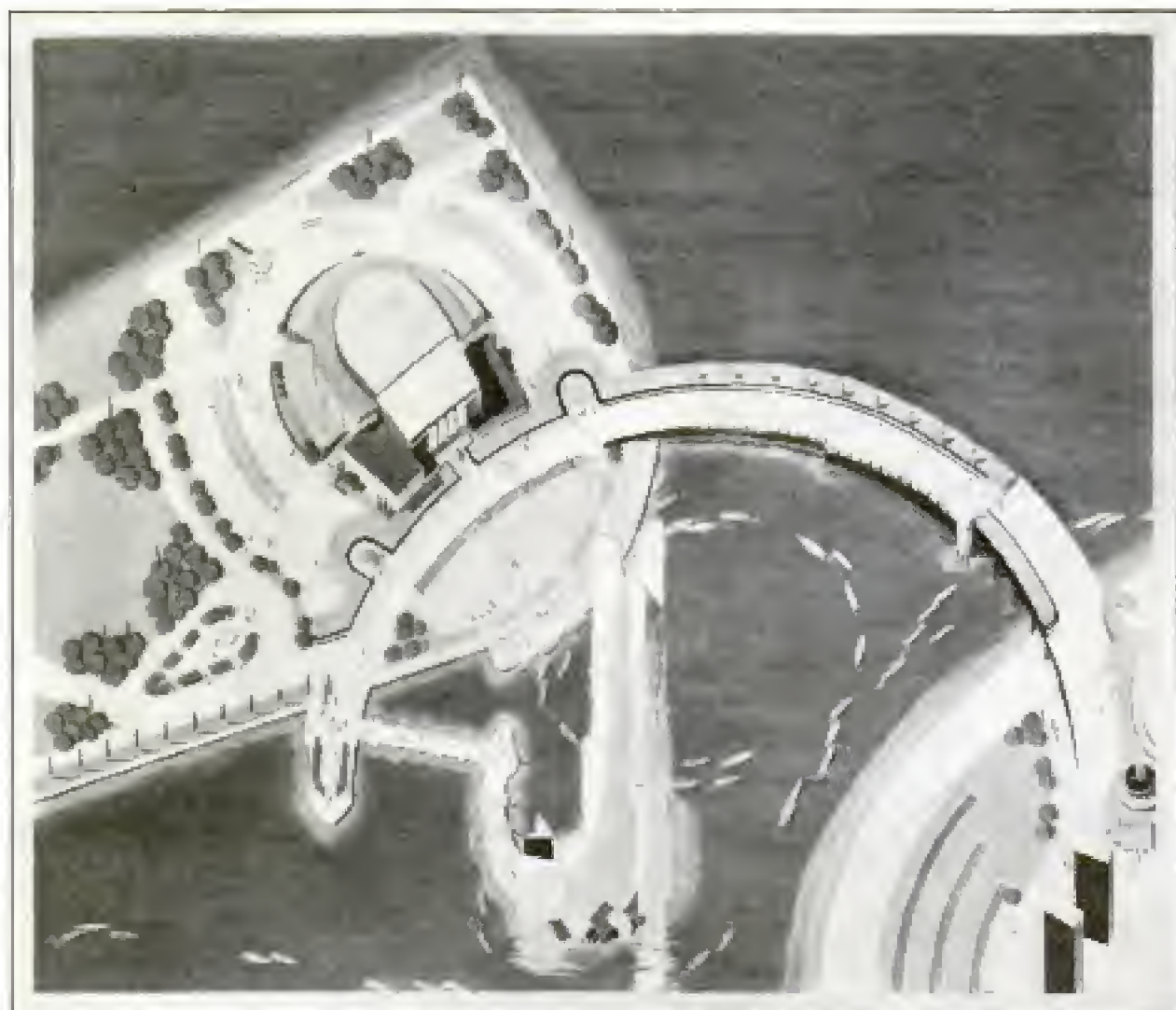


Above, North Approach to Hall of Science; Right, Looking through Windows of Hall of Science, Showing the Angular and Symmetrical Wall Effects, Which Will Be Lighted



West View of Administration Building; the White Central Portion Stands Out in Striking Contrast to the North and South Wings, Which Are Painted in So Dark a Shade of Blue as to Appear Almost Black

B-850
14



Architect's Drawing of Proposed Music Group; the Horseshoe-Shaped Auditorium, Upper Left, Will Seat 4,000 and Have a Stage Accommodating an Orchestra of 100 and Chorus of 600

lights and rich colors will replace to a great extent the usual architectural ornamentation of buildings such as are used for exhibition purposes. This permits the structures themselves to be constructed along very plain and inexpensive lines. The most costly item in the illumination scheme is the current consumed, because all the effects are achieved with comparatively inexpensive materials since they are intended to be used for only six months.

NERVES FORCE HAND TO MOVE 90° AHEAD OF BRAIN'S ORDER

If you drop a hot dish, don't feel too badly. Your fingers probably loosened their hold without an order from your brain, due to the fast-acting nerve reflexes. Science has found that the nerves frequently cause parts of the body to move before the sensation of pain can reach the

brain. By measurements with fast electrical instruments, Prof. Alexander Forbes, of Harvard medical school, has found that a cat stepping on a thorn with its hind foot will jerk that paw away three or four-thousandths of a second before the nerve carries the pain sensation to the brain. In almost every case, the ulnar or "crazy" bone responds before a person knows that the nerve has been hit. Pictures taken electrically show that nerves transmitting a man's will to keep his arm tense carry the orders from the brain in jerks. About twelve orders per second are transmitted, usually with one nerve fiber carrying the tensing impulse. Occasionally, other nerves join in the signaling, apparently to give the "other fellow" a rest. Their co-operation keeps the arm steady, despite intermittent signaling. It is only when a patrol of fibers lose this co-ordination that trembling and palsy result.

at meeting of American Philosophical Society

H. Joseph New Press
4/20/32

B.904
Hans Philip

B.864.

DIVING 'POLLIWOG' TO EXPLORE SEA FLOOR

Shaped much like a gigantic polliwog, a diving apparatus, said to be capable of resisting ocean pressures at depths of 10,000 feet, has been invented by a Cologne engineer for exploring the sea floor in deep water. The diver weighs two and one-half tons, is self-propelled, and, upon sinking, the inner pressure is automatically adjusted to the water pressure by gradual evaporation of liquid air. The pilot sits in an inner chamber specially constructed to withstand the enormous pressure of the air evaporated in the outer cell, and manipulates the craft by a series of rudder controls. A hollow sphere, mounted on a rod and attached to the top, acts as a buoy to keep the craft upright. Electricity, fed through a cable from the escort craft, provides power.



General Picture News
Class of English Officers Is Taught Military Tactics by Instructor Who Uses Toy Soldiers, Tents, Motor Trucks and Railway

TOYS TEACH THE ART OF WAR TO FUTURE GENERALS

All the movements of an army in the field are demonstrated to British soldiers by a model containing one thousand pieces. The model shows soldiers, trains, motor trucks, barracks, tents and other military paraphernalia. The correct method of moving supplies from the base to the front line in time of war is among the courses taught to British officers. Capt. C. H. Masse, of the British army, spent two years on the model. 46th Dec.

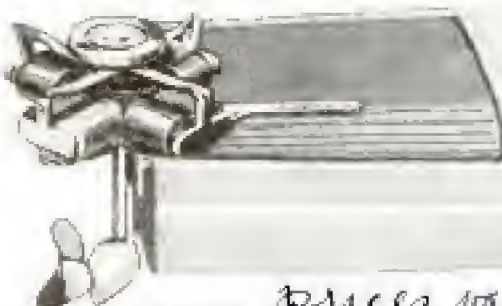
"LOST" CHEMICAL AGAIN FOUND

A chemical compound prepared for the first time seventy years ago, and since then "lost" so completely that chemists had concluded that it never existed, has been rediscovered by Prof. W. A. Naves, of the University of Illinois. The compound is nitryl chloride which was first prepared by a German chemist. Afterward several other scientists tried their hand at reproducing his work but with very uncertain success. The compound is a pale yellowish-brown gas, quite unstable chemically, which makes its isolation very difficult.

Urbana, Ill.

REAL MOTOR RUNS TINY BOAT ON FLASHLIGHT BATTERIES

Driven by an electric outboard motor, a toy boat that runs on flashlight battery cells has been produced. The rudder may be set so the boat will return to the starting point. The motors and materials for



Note the Flashlight Cells That Provide Power for Electric Motor on Toy Speedboat

building an electric boat also are available as an aid in teaching the fundamentals of electricity and boat construction.

Sand's Level Tool Co
8631 Isratist Ave
Lebanon, Ind.

Richard Mueller

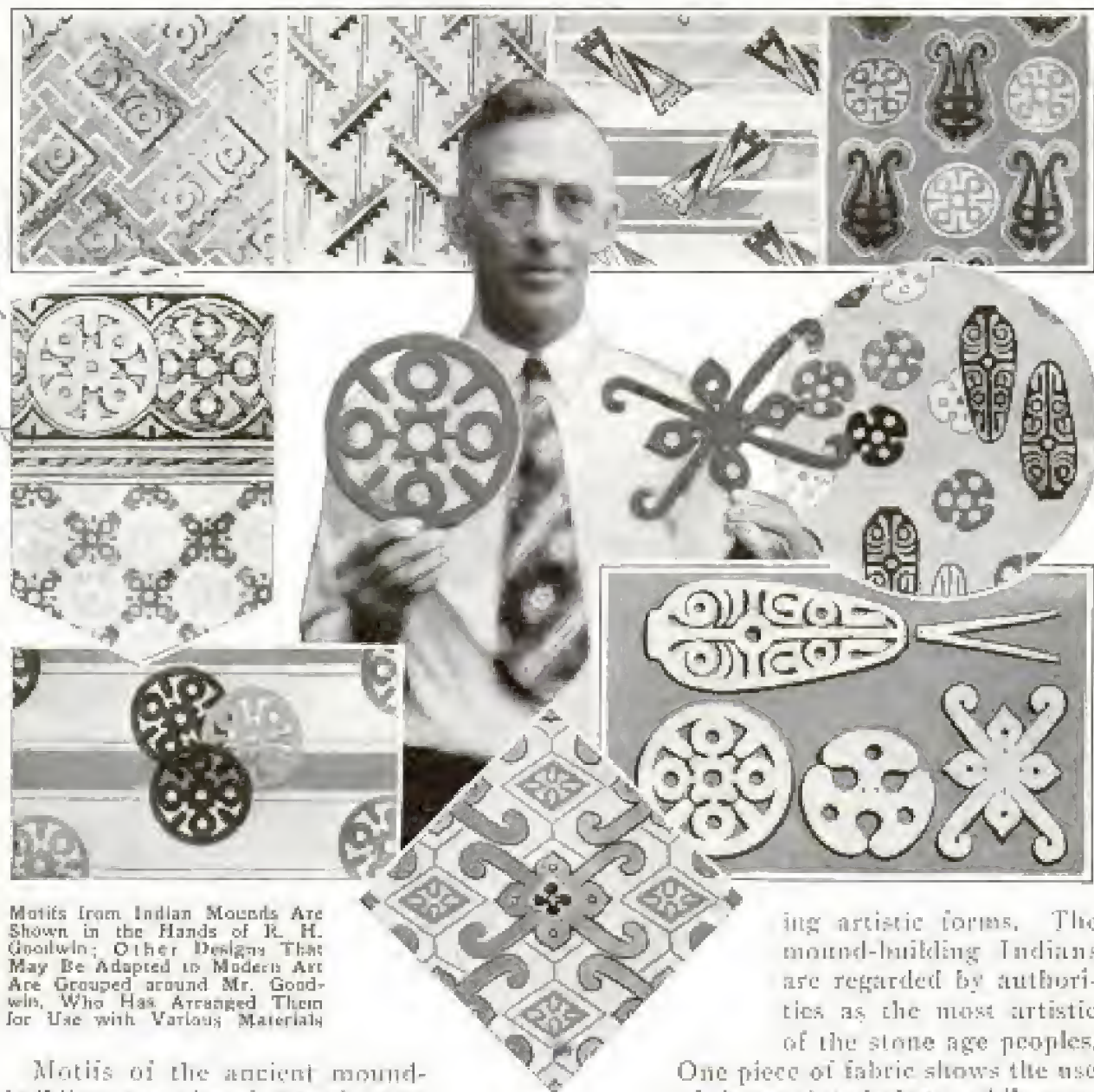
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NO2Cl

Mound Builders' Relics Yield Modern Art

Cont. American
Mills, 216 1/2 E 3rd St
Dayton, Ohio



Motifs from Indian Mounds Are Shown in the Hands of R. H. Goodwin; Other Designs That May Be Adapted to Modern Art Are Grouped around Mr. Goodwin, Who Has Arranged Them for Use with Various Materials

Motifs of the ancient mound-building people of America are helping modern designers by supplying beautiful patterns that once were used in tribal ceremonies. Dust heaps of mounds in Ohio have yielded objects in stone, copper, bone and mica, all carved into pleas-

ing artistic forms. The mound-building Indians are regarded by authorities as the most artistic of the stone age peoples.

One piece of fabric shows the use of decorative designs, while copper and mica objects reflect the artists' study of native animals. R. H. Goodwin, of the ~~Archaeological and Historical Museum at Ohio State University~~, has combined the motifs for new decorative uses.

Columbus, Ohio

NIGHT SKY IS RED, NOT BLACK, TO CAMERA LENS

20-913

If the human eye were sensitive enough, the sky would appear red or orange at night, instead of black. Photographs taken with a spectroscope reveal that the night sky has a visible spectrum or series of colors. It does not come from the light

of stars, but appears to be an emission of light from some other source. The radiation is the same thing as sunlight, although vastly less in quantity. The first night-sky picture showed an auroral spectrum line, green-yellow in color. The same line is emitted in the light of the Milky Way. The next photograph showed an orange line, and another red light.

St. Louis Post Dispatch
5/3/32

Announced by Dr. I. E. Melhus, Botany and Plant Pathology Dept.

B. 709

CHEMICAL GUN CLEARS WEEDS FROM YOUR LAWN

Dandelions and other weeds can be cleared from your lawn by a chemical "gun" designed for killing individual plants. By "shooting" each weed with one of two suggested sprays, the grass is not damaged. One spray has ten parts creosote and ninety parts kerosene, while the other is ten parts furfural and ninety parts kerosene, with a small amount of road oil to mix the principal components. A tin tube containing the spray is equipped with a plunger. A valve on the lower end of the tube is forced open when the plunger is pressed down, spraying the dandelion with a small quantity of chemical. This treatment may be applied spring, summer or fall. For filling in bare spots left by the removal, blue grass will grow rapidly if ammonium sulfate is applied at the rate of two to three pounds per square rod.

SHOCK-ABSORBER PLANE CABIN TO SAVE PILOT IN CRASH

Powerful shock absorbers built into the fuselage of an airplane recently tested in France saved the pilot from death and injury. The ship was pushed over a cliff sixty feet high, crashing onto the rocks and rolling over several times, but the inventor emerged unhurt from the shock-absorbing cabin. The fuselage remained intact, while other parts of the plane were smashed. In previous tests, crates of eggs were undamaged when taken from wrecked models. To make his test, the inventor



Shock-Absorber Plane after the Crash; Note That Fuselage Remained Intact

was forced to elude the French police, who refused to permit the demonstration on the ground that it was suicidal.

*Robert Sauvart
Frenchman*

Looking Like a Visitor from Some Other Planet, the Wearer of This Suit Is Protected against Gas



ROBOT-LIKE COSTUME GUARDS FUME FIGHTERS

Protection from poison gases is provided by a suit that covers the fume fighter from head to foot. A mask with air-purifying equipment covers the head, while an overall-like suit and boots of fume-resisting material guard the body, legs and arms from gas burns.

ELECTRIC CHARGES FROM CARS SHOCK TOLL MEN

Static electricity built up in the metal bodies of automobiles and in passengers has been transferred to toll collectors on the high steel bridge over Sydney harbor in Australia, resulting in unpleasant shocks. Engineers explained the phenomenon as caused by the clean atmosphere of the bridge which did not permit the electricity to escape, as it usually does, on particles of dust. When the toll takers touched the cars, the charge passed through their bodies and into the steel bridge. Rubber gloves and rubber-soled shoes now protect the bridge tenders.

Cont. W. L. Lewis

Does Superstition

By EMILE C. SCHNURMACHER

Left, Toy Mascot of Woman Flyer; Center, Voodoo Doll and Drum; Below, Hindu God, Said to Have Lost Head through Evil Eye



Wissler, anthropologist of the American Museum of Natural History, "like some child clinging to its faith in fairies.

"The difference between civilized people and savages rests largely in the relative richness or poverty of their ideas. Whereas the savage has many common-sense

VOODOO drums, the tambor-Kada, throb in pulsating echoes from the towering hills and high above the leafy jungle, on the bleak ranges so sinister in the twilight, little pin points of fire begin to appear. They are signal fires in Haiti, land of voodooism.

From the grim fortress of Christophe to the modern city of Port au Prince there is black magic in the air.

Close your eyes, stick a pin in a map of the world, and where the point of that pin descends, you will find superstition and the belief in black magic. Whether it be among the Dyak pygmies of Borneo, the "hex" (witch) cult of Pennsylvania, the bush negroes of the Guianas or the people of Broadway and of Park avenue in New York City, you will find the belief in good and bad luck deeply ingrained.

"We cling to magic," says Dr. Clark



ideas, his inability to explain most natural phenomena leaves him no other method

Still Rule the World?



Baby Shoe on Front of Car DePaolo Drove in Indianapolis; He Placed It There to Ward Off Accidents after Several Wrecks

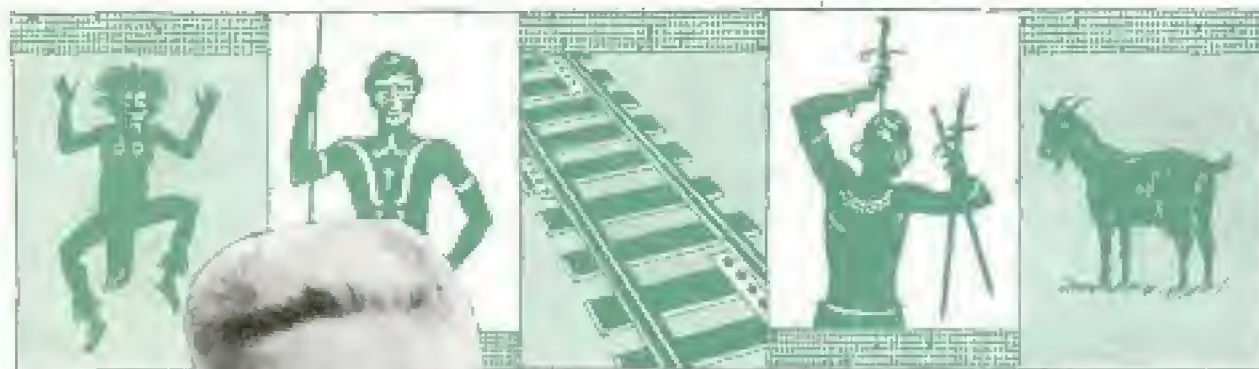
but magic. Civilized people also use magic if they fail to understand the cause and agencies involved." Just how far does the "black art" govern your own actions? Do you think that a person will be cross if he "gets up on the wrong side of the bed"? Will you have bad luck if you open an umbrella in a house, see a black cat cross your path, walk under a ladder or do something important on Friday the thirteenth?

Will you have good luck if you see a hay wagon drawn by a white horse, find a horseshoe or a four-leaf clover? Do you believe that fish is a brain food, or that rainy weather is the cause of rheumatism?

These are but a few of the hundreds of everyday superstitions, symbols of the black art, which are instilled in all of us from babyhood and which we carry right through life. Two years ago at Miami, when Gar Wood was about to race his motorboat at death-defying speed in an

attempt to break the hundred-mile-an-hour mark, I saw him finger the two little teddy bears he carries around his neck, tied to a piece of string. "I always wear them when I drive a speedboat," he told the writer. "They bring me good luck!"

Captain Frank Hawks, the famous aviator, is another example of the modern man who is dominated to some extent by the black art. Many flyers shook their heads and prophesied dire happenings when Captain Hawks christened his fast monoplane "Texaco 13." And yet Captain



Hawks is not so boldly defying the black art as it seemed at first. For while he openly challenged the evil influence of number thirteen, he compromised by carrying on his instrument board a lucky "Felix Cat."

Modern science is the active foe of the black art and is today making great strides in its battle with superstition. Yet both are after the same objective. Science is a persistent and painstaking effort to find out the facts of nature and man, and to formulate rules governing natural and social phenomena. Black art, or magic, or superstition—call it what you will—is the effort to gain control of man's environment, natural, social, spiritual, to prophesy coming events and to explain

those that have already happened.

The more sinister aspects of black magic—witchcraft—flourishes in civilized countries today along with the most inoffensive superstitions and beliefs. In Scotland, the last witchcraft execution took place in 1722 and the witchcraft statute was repealed in 1735, yet belief in witches continues to this day. In Wales, in many European countries and in America itself witchcraft is still believed in and, what is more, is still practiced. Only last year a hex murder in northern Pennsylvania created newspaper headlines in the press throughout the country and resulted in an expose of the practices of hex doctors.



Above, Gar Wood, Speedboat Driver, and His Good-Luck Bears;
Below, Fort of Christophe, Scene of Many Voodoo Ceremonies

"The school has done very little to eradicate magical beliefs from the minds of the common people," Dr. A. O. Bowden, president of the New Mexico State Teachers College, recently told the American Association for the Advancement of Science.



Doctor Bowden found no relation between the amount of schooling a person has had and the extent of his belief in magic and superstition, although there was a relationship between the decrease in magical beliefs and the amount of reading done after leaving school. Eighty-six persons out of every hundred believe that beautiful pictures, fine music and fine home surroundings will make people moral and virtuous. Sixty-five per cent believe fish to be a better brain food than bacon. And ninety-two per cent believe that the great majority of American people, by reason of an innate ability to tell right from wrong, will naturally take the right side of any big public question in the state or nation when allowed to vote on it. Belief in the black art in the United States is about equally divided between the sexes, Doctor Bowden has found.

Not all black art is ancient. Some is modern and bound up with the occupation in which you are engaged.

Let us take the theater, for example. Acting is a profession that attracts intelligent men and women. Yet, once they step into the theater, they become superstitious.

They must never speak the last line of the play during rehearsal, whistle in the dressing room or rehearse a new play if



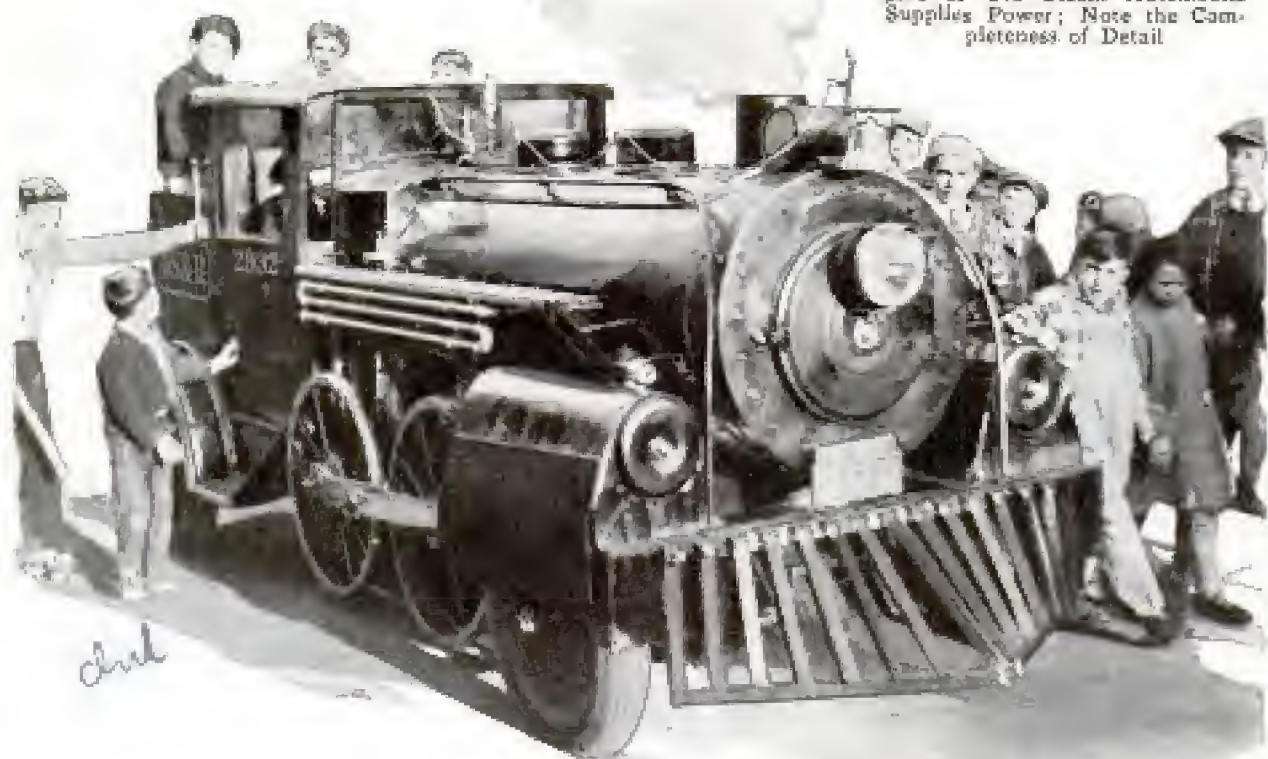
Capt. Frank Hawks, Who Has Set Many Records for Speed in His Ship Carrying Number Thirteen, and His "Felix Cat" on Instrument Board

the curtain is down. Any of these things is sufficient to "jinx" a play. A "camel-back" trunk backstage, or one bound with rope, is unlucky. To "open on Friday means close on Saturday." Peacock feathers, religious music in a play, Arab costumes and flowers all are unlucky.

If the "pilot" light, which is used to light the stage, should sputter, the omen is bad. If it is extinguished, the actors start packing up. Some of these superstitions are handed down from previous generations of actors.

How much do similar unfounded beliefs affect you?

This Locomotive Takes to the Open Road on Rubber Tires; Engine of Old Steam Automobile Supplies Power; Note the Completeness of Detail



STEAM AUTO LIKE LOCOMOTIVE HAS EIGHTY-MILE SPEED

Built over the chassis and engine of an old steam automobile, a locomotive with rubber tires has been completed by a fifteen-year-old boy. Top speed of eighty miles an hour is possible with the "iron horse" of the open road.

APARTMENT HOUSES FOR BEES ARE THREE STORIES TALL

Up-to-date bees live in three-story apartment houses instead of ordinary box hives. The department of agriculture has

developed a beehive consisting of a movable base where the inmates enter, surmounted by three removable wooden compartments. The bottom one, the largest of all, contains large square frames where the bees deposit honey that on the market is listed as fancy. Between the bottom and second compartments is a steel screen to exclude the queen from the other quarters, because it has been found that separating the brood results in better honey. The second frame is similar in construction to the first, but the top one contains honeycomb boxes which, when filled, may be wrapped immediately for market.

DUST ELIMINATOR SAVES LIVES OF ROCK DRILLERS

Lives of rock drillers will be lengthened by a dust eliminator designed to prevent, or greatly reduce, the ravages of silicosis, a disease caused by particles of silica finding their way into the lungs. Drill operators have a life span of ten to fifteen years after starting work in the dust-filled atmosphere of their trade. The eliminator consists of a sort of tin hat, with a hole in the top for the drill, to fit against the



Beehive Containing Three Separate Compartments Surmounted by a Removable Roof Admitting Air

Col. Roger Hawthorne
City Rm. Washington
D.C.
Semi, Washington, D.C.

Perfected by George S. Kelley,
Mech. Engineer. George J. Atwell
Foundation Corp. 136 E 57th
New York

B424

POPULAR MECHANICS

23

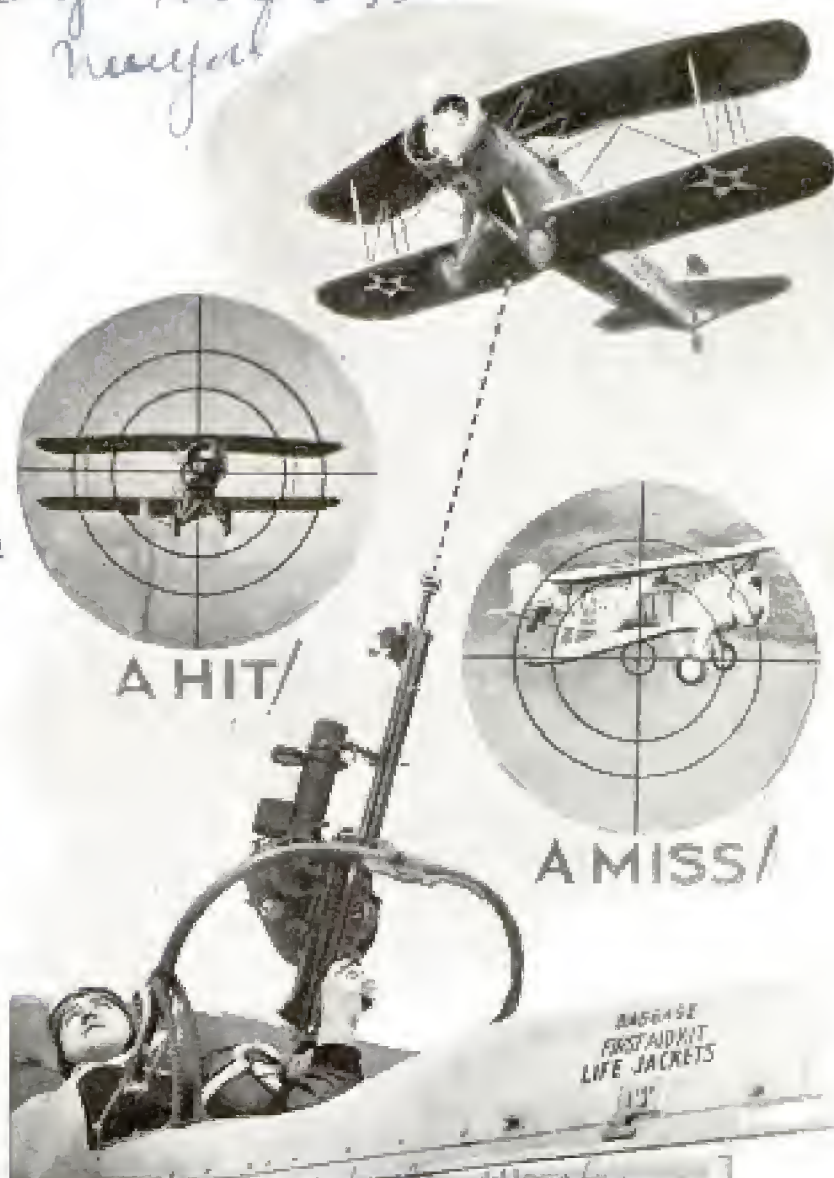
ground. Dust is drawn by suction from beneath the hat into a separator. The device has been found practical in open excavations and in mines, where it is substituted for wet drilling. Its inventors unwittingly have put themselves into the paint business, for each eliminator collects a cubic foot of silica dust in eight hours of drilling. Silica is valuable in giving a hard finish to certain paints.

B152

BULLET AND LIGHT RAY TO END STOP WATCH ERRORS

Errors in timing races with stop watches are eliminated by an automatic timer that registers to one-thousandth of a second. In a test, the stop watch recorded one runner at ten seconds, while the electric timer showed one-tenth second more. In the electric-timing system, a copper wire stretched across the muzzle of the starting pistol is broken when the cartridge is fired. This breaks an electric circuit and starts a high-speed clock or chronograph. At the finishing tape a light beam shines across the track and falls upon a photo-electric cell. Blocking of the beam by the runner as he crosses the finish line causes a signal to be sent to the chronograph. Hence, there are two printed marks, one indicating the start and the other the finish. Almost negligible corrections must be made for the lag of the electric current in printing the time when the pistol is fired and the crossing of the finishing line. In using a stop watch, the human element causes errors, so that a momentary hesitancy in snapping it will cost a runner a record. The new method was developed by Drs. Laurence E. Dodd and W. W. Harper, of the University of California.

Berkeley Calif.
Physicists



Flyers Practice for Air Battles by Shooting at the "Enemy" with Camera Gun; Pictures Show Where the "Bullet" Hit

CAMERA LIKE A MACHINE GUN TRAINS AIR MARKSMEN

For battle practice among the army's air pursuit squadrons, a gun has been developed that "shoots" pictures instead of bullets. In appearance almost exactly like a machine gun, and sighted in the same fashion, the camera is mounted in the observer's or gunner's cockpit during air maneuvers. Every time the trigger of the gun is pulled, a picture is taken, and at the end of the battle, the number of pictures of an opposing plane that appear on the film indicates the number of hits made by the gunner. Thus unerring marksmanship can be developed with the same type of equipment as used in war, without any danger of fatalities.

Usual Selfridge

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Electric

My Jones 4/24/32

B 932



England's Latest Fire-Prevention Station; Small Blazes in Forests Are Extinguished with These Brooms

FIRES FOUGHT WITH BROOMS IN NATIONAL FORESTS

Stacks of fire brooms are being distributed in the national forests in England in an effort to obtain the co-operation of the public in extinguishing camp blazes and preventing forest fires. The brooms consist of long poles to the ends of which are attached broomlike tufts suitable for beating out a blaze.

WOOD IS FILLED WITH GASES TRAPPED IN CELLS

Wood, even of the most solid kind, is not really solid at all, because from twenty to forty per cent of its total bulk consists of gases, trapped in the minute tubes and cell cavities of which all wood is composed. This appears from the researches of Dr. D. T. MacDougal, of the Carnegie Institution, who has extracted from various kinds of tree trunks gases containing the same constituent parts as air, but in varying proportions. Oxygen, making up about one-fifth of air, is often entirely

lacking in trees and never accounts for as much of the atmosphere of a tree trunk. Carbon dioxide, on the other hand, is far more abundant in trees than in the normal atmosphere, often running as high as twenty-six per cent. Nitrogen in tree-trunk gases varies from seventy-seven to eighty-three per cent. The gases in trees are in contact with the wet walls of vessels conveying water up to the leaves and pass into solution in this sap, and so are presumably used over again in the life processes of the tree which would account for the low oxygen content. It is probable also that the carbon dioxide, by-product of vital processes, is reabsorbed, carried to the leaves where food making is in process, and there used over again.

REAR SAFETY MIRROR FOR CAR TO SAVE MANY LIVES

Designed to reduce the 2,000 or more annual deaths resulting from inability of drivers to see directly back of the car when leaving garages or parking, a mirror has been produced to fit over the rear window of the automobile, in sizes for any model or make. The mirror is of metal, easily cleaned, and includes a roller to which the rear window curtain is attached. Its angle makes it possible for the driver or passengers to see even the bumper and everything for eight feet back of it, at which angle the usual rear-view mirror picks up the reflection. It obviates the possibility of children riding on the rear bumper unobserved, allows greater precision in backing, and makes it impossible for anyone to approach the car from the rear without being seen.



Helping the Motorist to See behind His Car, This Mirror Fastens over Rear Window

Edward Wallace
3380 Berkeley Road
Cleveland
Ohio

Washington, D.C.

at Lyndhurst, Hampshire Eng.
I receive Service Mail
4/15/32

Strange Radio Sign Talk Directs Broadcasts

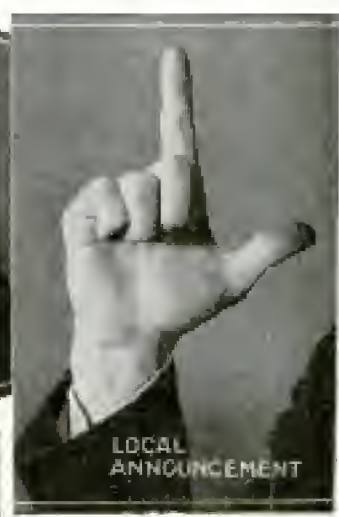


FADE-OUT



CUT PROGRAM

TO MUSICIANS—
CLOSE OFF



LOCAL
ANNOUNCEMENT



MOVE CLOSER
TO MICROPHONE

Some of the Signs Used to Convey Information in
Radio Studio and Their Meaning

While sign language is as old as man, almost the newest of industries, radio broadcasting, cannot function without it. Gesticulations of announcers and directors in the studio may be bewildering to the watcher, but the programs would be a hodge-podge if it were not for them. For instance, a finger pressed to the side of the nose means "the program is running according to time schedule." A hand extended with thumb and first finger at right angles signals the local station announcement. Network synchroni-

zation is indicated by crossing the fingers of one hand against those of the other. Two fingers in a shearing motion mean to "cut the program," when it runs overtime. Outspread fingers of an upheld hand drawn inward tell the musicians to move closer to the "mike," while, if the leader sees the director moving his hand in a circle, he knows the music is lagging and must speed up. Hands lowered with palms down mean to play more softly. Hands raised repeatedly mean to play louder.

CLOUDS ACT AS BURNING GLASS IN FOCUSING SUN'S RAYS

More ultraviolet radiation may be received on the earth on partly cloudy days than when the atmosphere is clear. That is caused, according to Dr. E. R. Weidlein, of the Mellon Institute of Industrial Research, by the clouds acting as a huge burning glass, concentrating the sun's rays. On clear days, most of the radiation from the sun is received direct. On a cloudy day, when the sun is partly obscured, most of its light has been absorbed by the clouds and that which reaches the earth has done so after many reflections. When the day is partly cloudy, some di-

rect sunlight reaches the earth. In addition, there are clouds so formed and so spaced that they reflect some of the sun's rays that ordinarily would have gone off in some other direction than to the spot where the direct radiation is falling. This makes it possible to have stronger sunlight than would have been the case if the day had been clear. That, too, is the institute's explanation for grandmother's warning to beware of sunburn on half-cloudy days in early summer, such burns usually being more severe than on clear summer days. Excess of ultraviolet rays was observed during several more or less overcast days in June, 1931, at the weather-bureau station at Pittsburgh.

Pittsburgh, Pa. Work done by H B
Meller and assistants

San Diego
Gunn 4/20/32

San Diego Gunn
4/20/32

B3682

The Secrets of Cooking



By BOB BECKER

GIVE any man an open fire in the woods, a supply of hemlock bark, hard maple, cedar, oak, or similar fuel, and he can turn out a meal that is fit for the most exacting palate.

The old days of associating the science of cooking solely with the housewife is gone. The program of outdoor life followed by hundreds of thousands of men demands food, good food and plenty of it, so there has grown up a school of "outdoor cookery" that can "point with pride" to browned hot bannock in a reflector oven, and other delectable dishes such as no woman and a gas stove could ever produce.

The man who can cook in the outdoors is a prize. His friends boast about his skill over an open fire and he is eagerly welcomed on a trip into the bush. A guide who possesses that art is considered a jewel among northern pines and hemlocks. His proficiency with a paddle and fishing rod fade alongside of the praises of his smoking-hot blueberry pies, crisp biscuit and filet of pike.

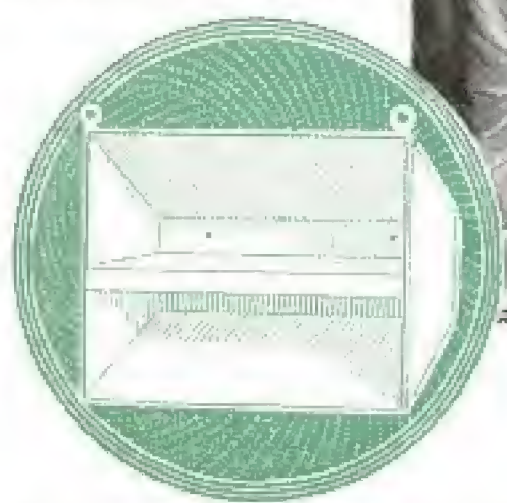
Camp Crane and Service Table Made from Poles and Cedar Bark; Note Cup Hanger Made from Branch

Cooking over open fires is not only quite a knack but also one well worth learning by every man who expects to spend some of his time in the open. Soggy, poorly cooked food can wreck more pleasure trips than weather or bad fishing luck. There are several fundamentals about foodstuffs which the beginner ought to know. First, don't carry flour, sugar and similar foods contained in paper sacks. If this is done, you'll find the sugar in the flour sack and the flour in the bottom of the pack sack when you reach camp.

Rule number one is to use waterproof food bags. These are ideal for beans, rice,

FOR MEN ONLY

flour, dried fruits, etc. Take a pen and mark each one so you can tell instantly what is in it. Secondly, avoid carrying foods in glass jars. If items like maple sirup are not in tin containers get the camper's old standby, the friction-top tin or can, for sale by any outfitting store. These are compact round tins with leak-proof tops. Use them for butter and matches.



Collapsible Camp-Stove and Bake-Oven Combination; Left, a Folding Aluminum Oven

In camp, you can submerge the butter tin in water to keep it cool. Third, carry your foods in a pack sack instead of old boxes, which are cumbersome and tiresome if you have to carry the load very far.

Inasmuch as knowledge of how to cook a good meal is partly dependent on having the proper foods to cook, here is a suggestion on a balanced food list. It's a tested list which played a big part in a wilderness cruise by canoe through a Canadian lake country. This list of supplies is practically a standard one for a canoeing or camping party of two for ten days.

ESSENTIALS

- 8 to 10 pounds of bacon
- 4 pounds flour
- 2 one-pound cans Crisco
- 5 to 6 pounds sugar
- 4 pounds pancake flour

- 2 pounds rice
- 2 pounds navy beans
- 1 pound salt pork
- 2 to 3 pounds coffee, in metal cans
- 8 loaves of bread, or extra flour to make bannock or biscuit in camp
- 1 can powdered milk or 12 cans of milk
- 1 peck potatoes
- 2 pounds salt
- 1 can pepper
- 4 to 5 pounds dried fruits
- 1 large box matches
- 3 pounds onions
- 1 cake sapolin or Dutch cleanser
- 1 yard towel
- 2 to 6 candles
- 1/4 to 1/2 pound baking powder
- 2 to 3 pounds of butter, packed in friction-top cans
- 1 bar of ivory soap, for cook outfit.

The following list, while not absolutely essential, is a desirable one. Take your choice according to taste.

- Dehydrated vegetables in metal cans
- 1 quart of maple sirup for the pancakes
- 1 package rye crisp
- 1/4 pound of tea
- 6 to 12 cakes of sweet chocolate
- Oatmeal or other breakfast food
- 1 pound raisins
- 2 pounds cornmeal* for frying fish, or 4 pounds if you like hot johnnycakes or cornmeal mush



Two Forked Sticks and a Pole Are All the Needed Equipment for This Cooking Fire over Which an Entire Meal Can Be Arranged

4 pounds ham
Cheese
1 dozen lemons and a can of lemon powder
Jam
Powdered soups
Can of dried beef, roast beef, desiccated eggs, etc.
Curry powder. I like this item for seasoning. Try it.

To learn how to cook in camp over an open fire is a matter of watching an old hand at the game and following directions in measuring out the ingredients of a recipe. However, the handling of the fire is no small part of success, so anyone learning to wield the skillets and the kettles will do well to keep in mind a few basic principles about woods and their heat-giving qualities.

For one thing, you may see the guide cook cut a lot of dry cedar to start his fire

and then, when this snapping, popping wood is going, he'll cover it with hemlock bark, if this valuable wood is available. The reason is obvious. Hemlock bark burns down to a bed of coals that last a long time after the quick-firing cedar is gone. Hemlock thus makes a wonderful cooking fire, a steady, even heat from glowing coals. The ex-

cellence of hard maple, hickory, hemlock bark, most of the oaks, and white ash for cooking soon can be learned in the woods as well as the value of tamarack, balsam and basswood for quick hot fires.

Now the wood has been gathered, a fire is crackling beneath the camp crane and we're ready to cook the evening meal, which is going to be as follows: vegetable soup, fried filet of wall-eyed pike, crisp bacon, French-fried potatoes, jam, hot haddock and stewed fruit. The folding reflector oven, already next to the fire, is almost indispensable to the camper who wants real food.

Here is a recipe for frying fish that will melt in your mouth. If followed exactly,

it will result in crisp brown fish instead of soggy, greasy ones. First, if you have wall-eyed pike or other large fish, cut small steaks from the sides of them and then wipe them dry. If small fish are being fried, finish dressing them by cutting the backbones in two or three places so they won't curl up in the pan. Then roll the whole fish or the filets in cornmeal and drop them in hot fat. The secret of frying fish is plenty of hot grease. Small fish or medium-sized filets should be immersed in it. If the fish

Camp Cook Tossing Flap-jacks with a Long-Handled Frying Pan

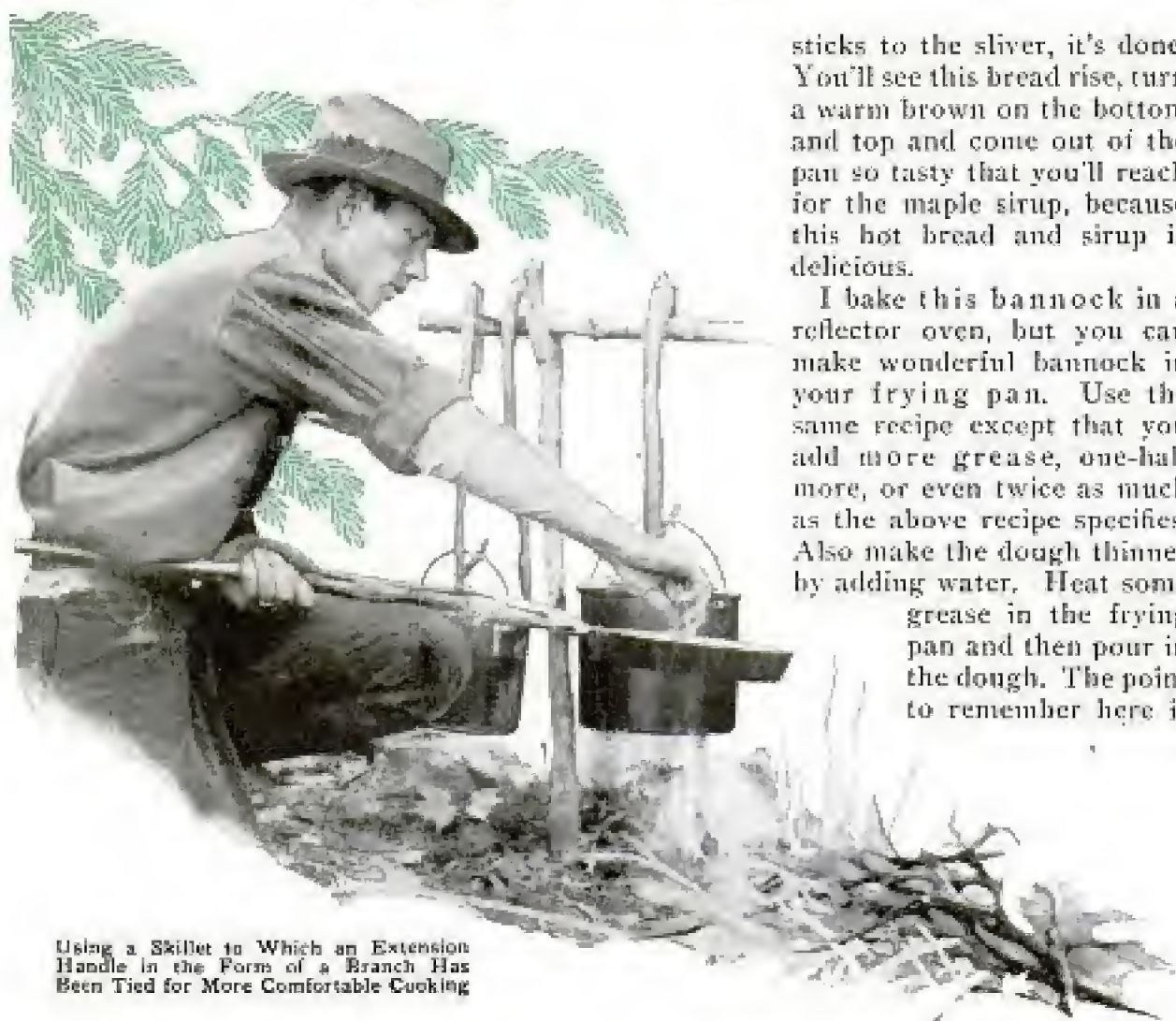


are not wiped dry or the grease is not piping-hot, the result will be soggy food. Another very important point is this: Place the pieces of fish in the hot grease one at a time. You mustn't add them too rapidly, or it will lower the temperature of the frying fat.

The average camper usually grills or broils his fish, and they are delicious this way—brook trout come out so crisp and brown that you can pick them up in your fingers and eat 'em. But if you want a fish course fit for an epicure, "listen" to this camp recipe for a planked fish by a guide. I noticed a heavy slab of hardwood in the pack sack—a piece of wood two inches thick, almost twenty-four inches long, and eight or nine inches wide. It was dark, well stained and somewhat charred. This was his fish plank,

To plank a fish, he split a pike or a big

bass down the back and clear through to the skin on its belly. While doing this he removed the backbone and most of the other bones. After cleaning and wiping this fish dry, he spread it out like an open book on the plank, which had been greased with bacon fat and heated in front of the fire. Then he tacked it to the plank, skin side down. He propped this fish in front of a bed of coals, reversing its position occasionally and every now and then touching the fish with a little butter. When is a planked fish done? That's easy. When the flesh is flaky. You can tell quickly by sticking a fork into it. When the fish was a beautiful brown and smoking-hot, the guide dusted it with salt and pepper, moistened it again with melted butter to which lemon juice was added, and then placed it right on the table to be served from the plank.



Using a Skillet to Which an Extension Handle in the Form of a Branch Has Been Tied for More Comfortable Cooking

Now for the hot bannock or hot bread. It bakes quickly, and melts in your mouth when it comes right from the fire, but it dries out quickly, so don't bake too much at a time. Here's the recipe for two men:

1½ teaspoonfuls of baking powder; they are different, so follow directions on the can
 ½ teaspoonful of salt
 1½ pints of flour
 1 lump of grease about the size of an egg, or 1 heaping tablespoonful
 ½ pint of water
 If you like short biscuit, add more grease.

Mix the flour, salt and baking powder thoroughly with a spoon. Then work the grease into the other ingredients until you haven't a single lump in the mixture. Then add the water and keep a big spoon working until you produce a rather stiff dough.

Now grease your pan and either turn the whole loaf in it or divide it into several small loaves. But don't handle the dough any more than is necessary. Bake it in front of the fire in a skillet or in the reflector oven. To tell when the bread is done, run a sliver into it. When no dough

sticks to the sliver, it's done. You'll see this bread rise, turn a warm brown on the bottom and top and come out of the pan so tasty that you'll reach for the maple sirup, because this hot bread and sirup is delicious.

I bake this bannock in a reflector oven, but you can make wonderful bannock in your frying pan. Use the same recipe except that you add more grease, one-half more, or even twice as much as the above recipe specifies. Also make the dough thinner by adding water. Heat some grease in the frying pan and then pour in the dough. The point to remember here is

not to put too much dough in the pan at once. Now hold the skillet above the fire. The bannock will rise until it is easily twice its original height. When it has done this and the bottom of the loaf is brown, turn it out for a second, grease the skillet again and place the loaf in it, upside down. Now brown the bottom slightly. At this point, reverse the loaf again, prop the skillet in front of the fire, but not too close, and let the loaf bake slowly. What a bread when this is done! A flaky crust on the outside and light and tender on the inside.

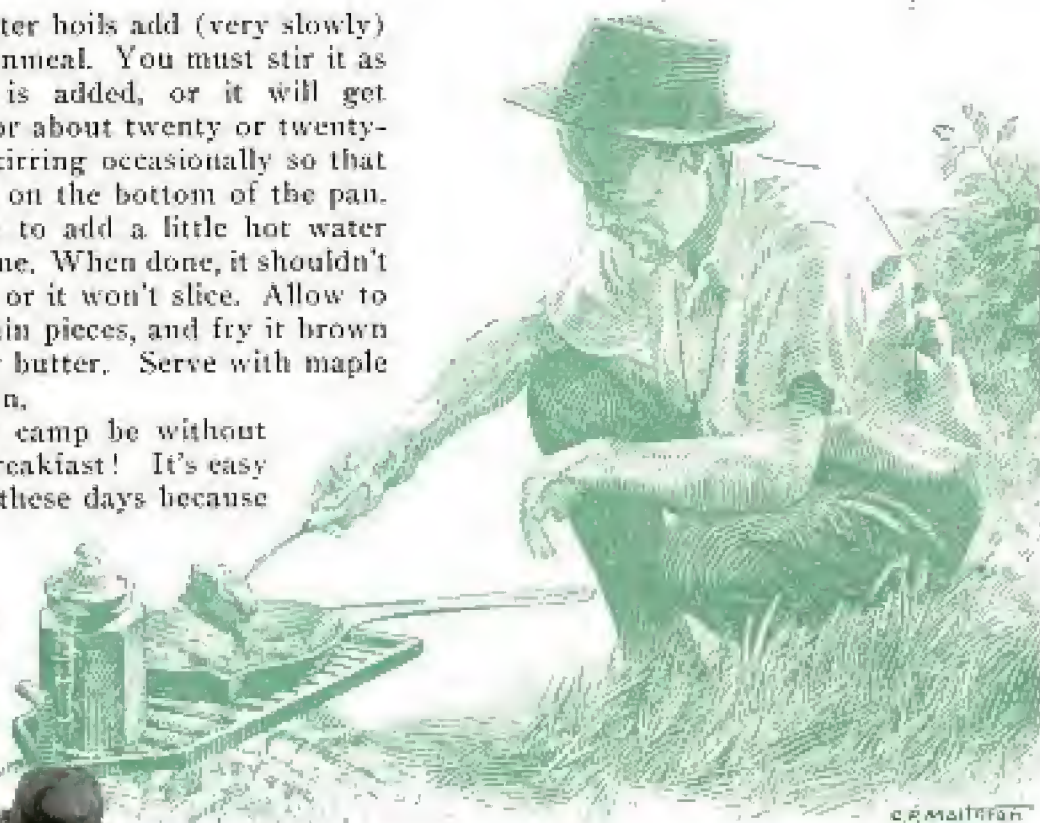
Fried cornmeal mush is a favorite in camp. A dish of stewed fruit, hot fried cornmeal mush with maple sirup, crisp bacon and piping-hot bannock baked in a reflector oven, fragrant strong coffee—there's a breakfast, mates, that sticks to your ribs. Here is a tested recipe for making cornmeal mush:

Take a clean pot, put in a quart of water and a good teaspoonful of salt. As

soon as the water boils add (very slowly) a cupful of cornmeal. You must stir it as the cornmeal is added, or it will get lumpy. Boil for about twenty or twenty-five minutes, stirring occasionally so that it doesn't burn on the bottom of the pan. You may have to add a little hot water from time to time. When done, it shouldn't be too watery, or it won't slice. Allow to cool, slice in thin pieces, and fry it brown in bacon fat or butter. Serve with maple sirup and bacon.

What would camp be without flapjacks for breakfast! It's easy to make them these days because

Right, a Handy Grate for the Small Camping Party; Below, Using a Boat Paddle for a Table in Slicing Bacon Next to Camp Fire



you can buy self-raising pancake flour, so all you have to do is mix with water or milk and stir up the batter. Carry this flour in a friction-top tin.

Don't try to make flapjacks over a fire thirty inches high. Let it run down to a big bed of hot coals or a low but hot smokeless flame. Another tip is—one big cake at a time. Put a dab of grease in the pan and then brown the cake on one side. The cook must learn to toss the flapjack in the air and catch it raw side down, or it isn't real camping. Just before tossing it, add some grease to the pan and then up she goes, while your camp mates stand on the side lines ready to "pan" you if you miss. I practiced this with a tough cold flapjack for a long time before I tried my luck with a hot one. Not a bad idea!

In cooking meats in camp, most of us use the frying pan. However, in the preparation of small game, such as rabbits, squirrels, grouse, it is easy to vary the fare by making a sort of roast with a skillet and a pan to cover it (cover the meat with strips of bacon, dust with flour, season, add water to the pan and let it bake over a slow fire or in the reflector oven) or by making what they call "san coche" in Trinidad.

I've eaten a variety of game cooked this way on southern hunting trips. It's easy to prepare and easy to take. Cut up your game in small pieces. For example, if it's rabbit or grouse or duck, unjoint the wings and legs and cut the body in four pieces. Stew them slowly. When nearly done, add a handful of ham or bacon cut into small squares, a half cup of rice (more if you like rice) and plenty of salt and pepper. I add a dash of curry powder because I am fond of this flavor, a tablespoonful of Worcestershire sauce, and at least a couple of onions.

I am sure that you'll vote this the most toothsome, appetizing and nourishing dish you ever tasted in camp. It's a meal in itself, especially with bannock and jam.

B-295

also exhibition of modern
Architecture at Museum
of Modern Art

32

POPULAR MECHANICS



Models of Steel Apartment Buildings on Stilts for Congested Sections in Cities; Space under Buildings Would Make Playgrounds

STEEL APARTMENTS ON STILTS PROPOSED FOR CITIES

Steel apartment houses, resting on standards fourteen feet high, are proposed as a form of construction well suited to congested metropolitan areas by one New York firm of architects. Such buildings are suggested particularly for a large area of New York's east side formerly occupied by tenements, the plan calling for the erection of twenty-four of them in U-shaped formation to accommodate between 8,000 and 10,000 persons. The estimated rental would be \$10.95 a room per month. The buildings would be without basements or ground floors. They would be of steel-skeleton construction, and the space under the buildings would be utilized for covered playgrounds. In addition, there would be large open areas between the buildings. The models show no court yards, nor would there be rooms on sunless sides or airless corners. On the sunny side of each building, there would be continuous windows, and the roof terraces would be utilized for recreation.

PULL OF SHIP'S GYROS EQUALS TEN LOCOMOTIVES

With the development of a new device for making ships more comfortable in rough seas, it is possible that the inventor, Dr. Nicholas Minorsky, has added something entirely new to ocean-travel com-

fort. The gyroscope, previously used for this work, is costly and also takes up valuable cargo space. The twist exerted by each of the new gyroscopes in a forthcoming liner is equal to the force of ten 500-ton locomotives going sixty miles per hour. The device makes use of the accelerometer, an instrument used in measuring and foretelling earthquakes. By this means the roll of the oncoming wave is anticipated and the ship is ready for it. A small gyroscope maintains the balance of the instrument. The ship is balanced by water tanks connected by a pipe in which there is a screw. By running this screw one way or the other, the water level is raised or lowered in the proper tank. The accelerometer does this automatically.

STRIPED STEPS ON SIDEWALKS PREVENT STUMBLING

To reduce the danger of stumbling over steps in a sidewalk leading to a Cham-



Sidewalk with Steps Banded by Stripes of Black and White to Reduce Danger of Stumbling

paign, Ill. hospital, stripes of alternating black and white have been painted on the risers. Even with poor illumination, it has been found, the stripes present a sharp contrast at night and warn pedestrians to exercise care.

University of Pennsylvania
Prila

Burns
Hospital
301 E. Springfield
Ave.

Have Leesege, 2508 43rd

Edwards

B-845

"SMASH-AND-GRAB" BANDITS BRANDED WITH DYE

To combat "smash-and-grab" bandits, a trap has been devised which pictures these thieves in action and brands them for future identification. When the bandit smashes a shop window, a spike gate drops to bar his entrance. Simultaneously, a hidden camera of wide-angle focus snaps his photograph, and he is sprayed with an indelible dye of conspicuous color to mark him for arrest. (Wallins)

BOTTLE-NECK MYSTERY SOLVED BY SOAKING WOOD

When a Cape Cod recluse died, he left a puzzle that hundreds failed to work until it was submitted to the faculty of Drexel Institute at Philadelphia. It consisted of a wooden shaft with a large arrow head on each end. Between the arrow heads and fitting closely around the shank was the neck of a glass bottle. How the bottle neck could be passed over an arrow head so large constituted the puzzle. J. Henry Rushton, of Drexel, reproduced the puzzle in two hours. A piece of wood, cut from common pine in the shape of the double-headed arrow, was soaked in water an hour. Then one arrow head was placed in a vise and compressed to the size of the shank, making it easy to slip through the bottle neck. When the compressed arrow head dried, it expanded to its original size.

How Did the Bottle Neck Get around the Arrow? This Professor Solved It



Conrad Eckhardt



© Planet News, Ltd.

This Extension Ladder for Fire Fighters Can Be Turned in Any Direction; It Is 104 Feet Long

FIRE ESCAPE LIKE TURNTABLE REACHES GREAT HEIGHT

Rotating on a turntable so it can be moved in any direction, an extension fire escape used by the London fire brigade can be shot into the air for a distance of 104 feet. The turntable and ladder are mounted on a truck, and the ladder is fitted with handrails. When placed at an angle, it forms a steep stairway that is fully protected, making ascent or descent easy.

SPEED OF BLOOD'S CIRCULATION IS SEVEN MILES AN HOUR

Calculations of the speed at which blood in a normal person circulates reveal that it passes through the veins and arteries at a rate of 621 feet a minute, with a heart-beat of sixty-nine times a minute at ordinary heart pressure. This represents a speed of seven miles an hour or 168 miles a day. In a year, the blood travels over 61,320 miles, and in a man eighty-four years of age it would have traveled in that time about 5,150,880 miles.

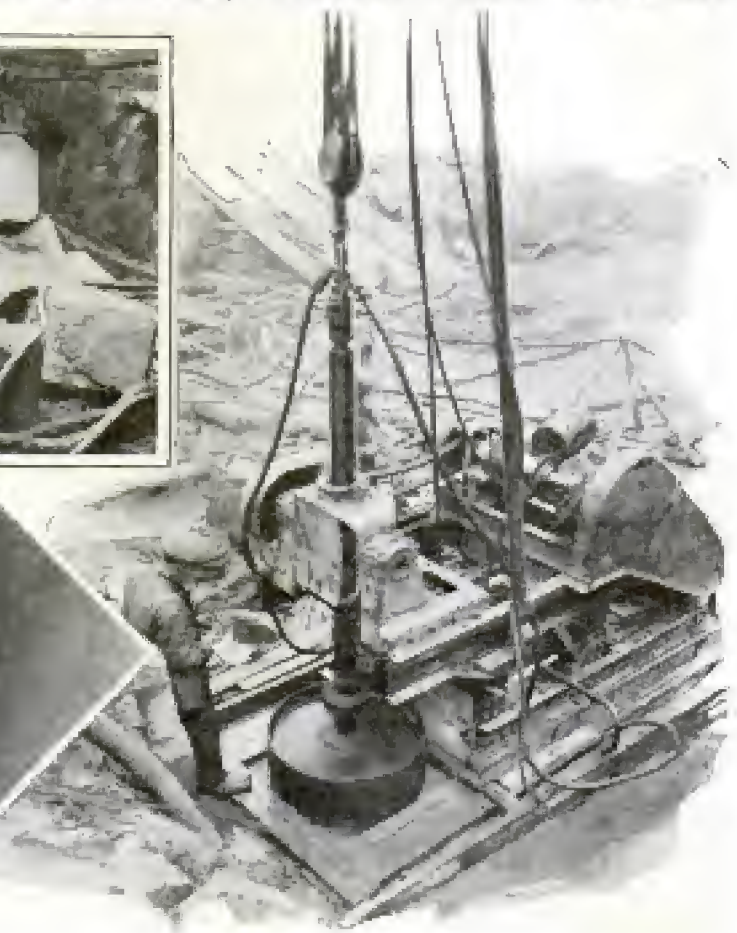
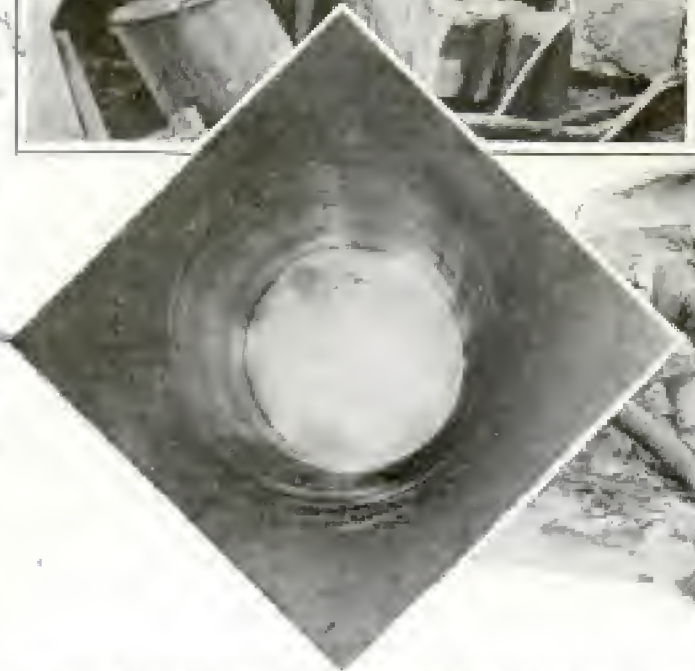
Everett Springs 1729

N. Capitol

Washington, D.C.

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Orchestra Platform on Elevators and Track



Top Left, Some Rock Cores Removed from Holes for Orchestra Elevator Shafts; Bottom Left, Looking Down One of the 42-Foot Holes; Right, Electric Drill Begins Job of Cutting Shaft in Solid Rock

Orchestras appearing in the International Music Hall of Rockefeller Center in New York City will be transported below or above the stage on a huge movable platform accommodating seventy-five musicians and capable of both horizontal and vertical motion. Merely by pressing buttons, the orchestra leader can cause the players to sink below the floor level in front of the stage to a point where the platform can be run on a track rearward, beneath the stage, and then be elevated at the back, if desired, to a position thirteen feet above stage level. The arrangement will produce some unusual effects and, at the same time, do away with the erection and removal of a temporary platform, usually made necessary when the orchestra is to be elevated at the rear. The movements can be reversed to bring the complete orchestra from a location at the rear to the customary position in front and below the stage-floor level. Vertical

movements will be made possible by four hydraulic elevators, two at the front and two at the rear of the stage, each cylinder being set in a three-foot shaft over twenty-eight feet deep, sunk in the solid rock underlying the building. In the center of the stage will be a section, seventy feet long and forty-four feet wide, consisting of three divisions of equal dimensions, each of which can be elevated independently of the others. There are four of the elevators for each section. These sections can be lowered to either of two floor levels beneath the stage, permitting changes of scenery at either location. The shafts supporting the stage sections are forty-two feet deep and three feet in diameter, and the maximum speed of the elevators is forty feet a minute, but the rate of travel can be regulated. There will also be a central circular section of the stage, forty feet in diameter, which can be brought to rest on a turntable and revolved. The

83 661

sinking of the sixteen shafts through rock was accomplished in record time with the aid of three special drills capable of digging holes three feet in diameter at a rate of four feet in a shift of eight hours, including the time required for removing core sections, varying from four to five feet in length. The drill consists in part of a vertical driving shaft to which is attached an open-bottom steel cylinder. The lower, or cutting, edge has a number of regularly spaced vertical slots, and into these are fed shotlike metallic particles. As the cylinder revolves, these particles act as abrasive agents, and in this manner an annular channel is ground progressively deeper. When the cylinder has worked its way downward four feet or more, it is withdrawn, wedges are driven into the channel and a small charge of dynamite is used to break the rock core, which is lifted out with block and tackle after an eyebolt has been wedged into a hole drilled in the center.

**"MERRY-GO-ROUND" IN WATER
TEACHES BOYS TO SWIM**

Speedy teaching of swimming is provided at a boys' camp in Maine, where a circular swimming device, or water "merry-go-round" has been installed. It consists of a strong upright post on a stationary floating platform. A long bar is pivoted on the upright piece so it will revolve, and to its ends are attached ropes with a loop on the end. The youngsters place the loops under their arms and move in a circle as they propel themselves by kicking and stroking, thus learning the mechanics of swimming.



Boys Are Taught to Swim by This "Merry-Go-Round"; Swimmer Is Supported by Line from Revolving Pole

*Edw. Newell & Logg.
Sanford, Maine*



Restrung a Tennis Racquet While the Player Waits Is Easy with This Mobile Repair Shop

**TENNIS SHOP IN MOTOR TRUCK
REPAIRS RACQUETS ON SPOT**

Tennis racquets are repaired on the spot by the operator of a California motor truck equipped with a workshop. A sliding plank fitted with vise and clamp brace is drawn from the rear of the truck when the doors are opened. Then the racquet can be restrung or lacquered while the player waits. Cans of lacquer are carried in small trays. Three sliding panels are fitted with new racquets, in case a customer is found. A distinctive whistle is used to announce the approach of the repair truck. Vise plank and display boards can be removed, converting the car into a common delivery truck.

Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

*Selection Newell, Lowell & Portland, Maine
House, 4229 & Vermont Ave. Portland, Maine*



Reproduction of a Famous Dore Painting from an Old Bible, Showing the Ancient Method of Converting the Cedars of Lebanon into Lumber for the Construction of One of the Temples of Jerusalem

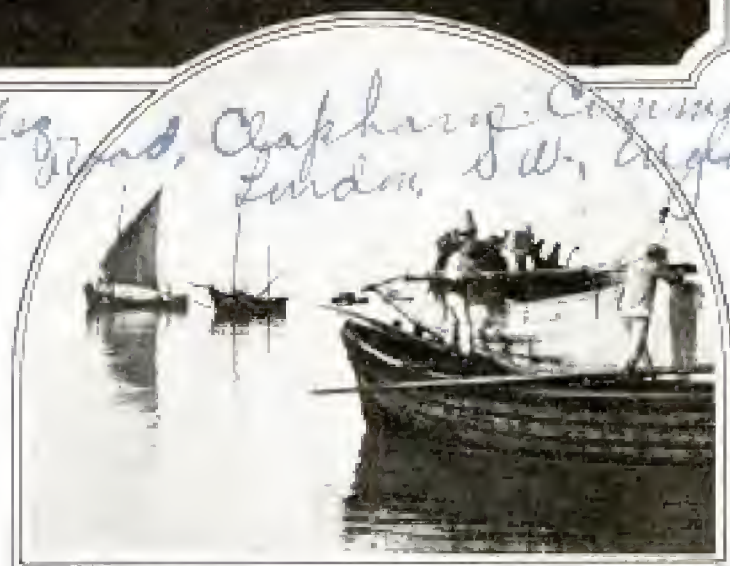
SCIENCE *in the* BIBLE LANDS

By H. J. SHEPSTONE, F.R.G.S.

NO country in the world is being more rapidly westernized than Palestine. The Holy Land of yesterday with its Biblical background is fast passing away. It is being placed upon the business map.

The holy places in and around Jerusalem are now dominated by towering edifices of brick and stone. The city boasts of its university, colleges, schools, hospitals, hotels, restaurants, movies, parks and recreation grounds. Its streets are electrically lighted; the city has an efficient water supply and a modern drainage system. Its citizens are conversant with the use of the telephone and wireless, and are carried to and fro in the latest type of American automobile or motor coach.

The waters of the River Jordan, where Christ was baptized, have been harnessed and are today driving huge turbines producing electrical energy which is carried to all parts of the country. The erection of the Jordan power station was no mean



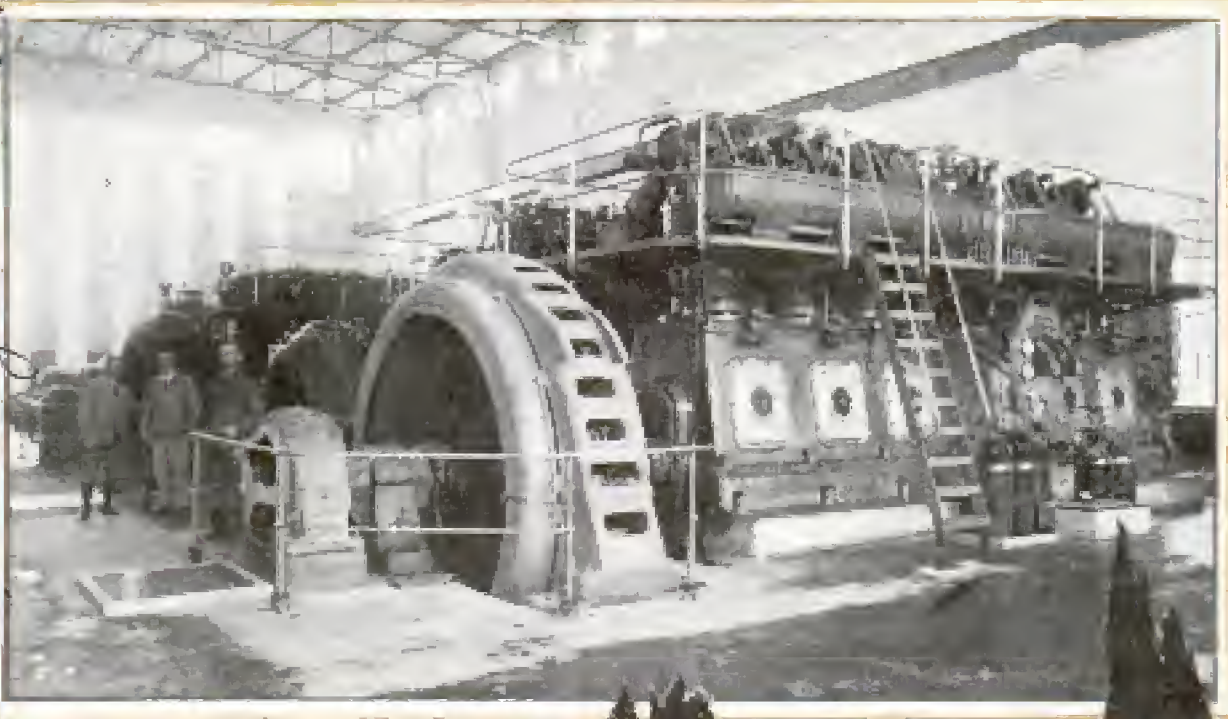
Top, Mosque of Omar in Jerusalem Illuminated at Night; Below, Native Craft on Dead Sea Engaged in Carrying Wheat



engineering feat, calling for the building of dams, digging of many miles of canals, and the creation of a great lake to the south of the Sea of Galilee.

The once quiet little retreat of Haifa, nestling under the shadow of Mount Carmel, has been converted into the Detroit of the Holy Land, with up-to-date factories and workshops. Recently completed enterprises include a large flourmill, and a modern oil and soap factory is now turning out 5,000 tons of its products a year. There is also a cement factory capa-

fuel power plant
at Haifa
Tel Aviv



able of producing 60,000 to 70,000 tons annually, and silk factories, glass works, box-making and other industries have been established, while a new harbor will be capable of accommodating the largest vessels afloat.

Just outside Haifa is the new ocean oil installation with a total capacity of 7,000,000 gallons of liquid fuel, brought all the way from the oil fields of Iraq. The dozen giant tanks, a conspicuous landmark for miles around, are linked with the sea by pipe lines, 6,000 feet long, 2,500 feet of which run out under the sea and along the bottom of Haifa bay, into water deep enough to float big ocean-going tank steamers.

The site of Mizpeh, where Samuel ruled Israel for twenty years, is now graced by a modern air-drome, and planes from London, Paris and Berlin use it as a terminus, carrying both passengers and mail. Weekly, too, a modern flying boat, running between London and Bagdad, regularly descends upon the quiet waters of the Sea of Galilee. The towns and villages have been linked by macadamized roads suitable for modern motor traffic, and there are over a thousand reg-



Top, Hydroelectric Power Plant in Holy Land; Below, Pottery Factory on Site of Pontius Pilate's House

istered cars in Jerusalem alone. The existing railroads have been overhauled and new lines laid, and preparations are now afoot for linking Jerusalem and Haifa with Bagdad by rail.

Down on the northern shores of the



Dead Sea, hitherto a barren and dreary spot, a health resort is rapidly rising. Piers and bathing establishments are being built, as well as a modern hotel and restaurants. Motor vessels are being placed upon these waters, and the spot connected with the Jerusalem highway by a motor road. Preparations are going on for the erection of an extensive plant here to recover the potash and other valuable minerals in this region. At Tiberias, on the Sea of Galilee, a spa with every modern appointment has been built over its famous hot springs, once used by Herod.

The peasant farmer is rapidly being superseded by the more enterprising and skilled Jewish agriculturist with his tractor and modern harvest and threshing machine. Not least, the country has now its own coinage and postage stamps.

This westernization of the Holy Land has been accomplished in just over a decade. Indeed, virtually all the improve-



Above, Main Dining Room of King David Hotel in Jerusalem Which Is Thoroughly Modern; Below, Entrance to the Big Hostelry

ments have been wrought within the last five or six years. All along, the work has been hampered by many difficulties. There have been disputes between the Arabs and the Jews, a controversy by no means wholly settled. Knotty problems have arisen



New Government House in Jerusalem; It Stands Outside the City Walls on a Location That Was Entirely Barren and Was Considered Waste Land Less Than Three Years Ago

over the rights of this sacred shrine and that, for Jerusalem is the meeting place of three great faiths—Judaism, Mohammedanism and Christianity. It is a city of three Sundays, Friday being the Moslem sabbath, Saturday the Jewish and Sunday the Christian. It is a city of three official languages—English, Hebrew and Arabic. All street signs and all official documents are printed in all three tongues.

The elements also have been unkind to struggling Palestine. A few summers ago it was visited by a severe earthquake and later it was called upon to fight the biggest plague of locusts recorded in modern times. The country has been swept by blizzards and the Holy City has suffered from drouths.

One of the first problems that confronted the British when they took over the country was the question of an efficient water supply for Jerusalem. Up to that time, the Holy City had been dependent upon the rainfall for its water. Today Jerusalem needs 800,000 gallons of water daily. It is obtained from three principal sources, the Pools of Solomon, the Urtas springs close by, and Ain Farah, a series of rock springs in the gorge leading to the Wadi Kelt, near Jericho. The harnessing of these springs and the pumping of the water up to Jerusalem necessitated the building of roads through mountainous and difficult country.

The city's old walls have been repaired and it is now possible to ascend them and make a complete circuit of the city along the old ramparts. The walls vary in height from thirty-eight to forty feet and have a circuit of three miles. Almost in the center of the city, by the side of the road along which Christ walked to His crucifixion, there is a modern pottery factory, built on the reputed site of Pontius Pilate's house.

Outside the old walls, there has sprung up a greater Jerusalem—splendid residential sections, public buildings, large hotels, colleges, hospitals, commercial edifices, parks and recreation grounds. Everywhere building operations are in progress, and some of the suburbs of the Holy City present the appearance of a boom town in America. Today, more than two-thirds of Jerusalem's 90,000 population live outside the walls. The hotels are fast moving out, and so are the big business houses and the stores.

Jerusalem has already spread almost halfway to Bethlehem on the south, the greater part of the way to Ain Karim, the birthplace of John the Baptist, on the west, and on the north to the foot of Mount Scopus. Curiously enough, this development of the Holy City follows closely the description of the rebuilding of Jerusalem as given in Jeremiah.

In all, some eighty streets have been

laid out, and their very names are pertinent of Biblical history, for we have such appellations as the street of the Prophets, Herod's way, Nehemiah road, street of Ezra, street of the Maccabees, Isaiah street, John the Baptist street, Jeremiah street and Hezekiah street.

A style of architecture in keeping with the land-



Photos © American Colony, Jerusalem

Top, Flying Boat on the Sea of Galilee; Below, an Aerial View of River Jordan Which Flows into That Sea

scape and traditions of the site has been encouraged. This is particularly noticeable in the various Jewish garden cities which have sprung up around the ancient walls. The houses are built of stone, with balconies, arched windows, spacious verandas and attractive entrances. Each stands in its own grounds with flowerbeds in front and behind.

Jerusalem's latest building is the new government house, occupying the highest point on the southern side of the city, a barren spot when the building was begun three years ago. The city's latest hotel, the King David, built at a cost of \$1,250,000,

is the last word in modernity. From its roof and terraces panorama views may be had of the old city walls. The hotel has 200 bedrooms, the majority with running water.

Much of the activity in Palestine today is due to Jewish initiative. They have spent over \$60,000,000 in the country within the last decade, and they are still spending over \$5,000,000 a year on land reclaiming, building, quarrying, and in maintaining agricultural settlements. Down on the coast above Jaffa, they have reared a modern and up-to-date city, Tell-Aviv, the first purely Jewish city to arise since the days of the Romans. It has a population of some 36,000 souls, all of whom are Jews. It boasts of its hotels, restaurants, synagogue, hospital and schools, electric light

and other modern conveniences and is fast becoming a busy industrial center.

On the plains and in the fertile valleys, one comes upon the agricultural settlements which have been established by the Jews. There are over a hundred of them, dotting the land all the way from Dan in the north to Beersheba in the south. Upon once swampy and mosquito-infested areas there are now farms, modern cottages, synagogues and institutes. In their equipment, these farms not only equal but actually eclipse many similar institutions in other countries, labor-saving machinery and electric power being used.

Com. Roger Hardborne
Washington
Washington DC

B. 457

This Masked Experimenter Is Shown with Apparatus Used in Treating Metals with Radium Rays in His Quest for Secrets of Transmutation



which reacts to the glare of oncoming headlights and switches the circuit from bright to dim. Dimming is not arbitrary, as the driver can cut out the switch.

B. 740
CRIPPLED DOG RIDES WHILE HE WALKS

At least one dog is able to ride while he walks. His legs and a part of his back were paralyzed as the result of an automobile accident and his Los Angeles owner made a two-wheeled cart to support his hind quarters, enabling the animal to get about with alacrity. The cart is made of metal and held in place by leather straps attached to a wide collar. Because the hind legs were paralyzed, it was necessary to extend supports from either side of the cart to keep the dog's body erect. As a result, the animal sits

on the support while walking with his fore feet. He chases cats and even climbs stairs without difficulty.



His Hind Legs Gone, This Dog Still Chases Cats: Note the Two-Wheeled "Chair" Serving as Legs

owner of dog, Mrs. Ward Watson, 1352 W. 6th St. Los Angeles, Calif.

Com. George A. Kravetz
W. 50th St. Los Angeles Calif
1642

Radiology - I noteable for Atomic Research Berlin

RADIUM TO CHANGE ONE METAL INTO ANOTHER?

Transmutation of metals is held out as one possibility of apparatus for treating metals with the alpha rays of radium. Evidence that atomic changes have occurred in treated metals is claimed by H. von Bohndorff, of Germany, in tests with photographic plates. Treated metals retain their radiation for a long time, and in touching a photographic plate have the power to penetrate a wrapping of thick, black paper. The experimenter hopes to convert metals on a large scale.

AUTO LIGHTS DIM THEMSELVES

Automobile headlights which automatically dim themselves at the approach of another car, is a recent development designed to relieve the driver. The system is controlled by a light-sensitive plate

in France, according to Dept. of Commerce in Washington

B. 834

Night Made Day to Speed Cleaning of Liner



Floodlights Dispel the Darkness to Speed Up the Seasonal Cleaning of the "Berengaria"; the Liner Is Shown in Drydock; Crews Work Night and Day to Rush the Ship Back into Service

Amid the glare of lights, the liner "Berengaria" was given her seasonal cleaning at Southampton, the overhaul crew working day and night to put the vessel back into service as quickly as possible. The liner was maneuvered into the floating drydock, the dock emptied of water and the work begun. Huge arc lights along the sides of the dock helped turn night into day for the repair and paint crews.

REFRIGERATOR TO HEAT HOME BY THROWING SWITCH

Throwing a switch on a new refrigerator turns it into a heating plant by reversing the cooling process. For summer operation, the apparatus is supplied with cold water from the evaporator, while the condenser is cooled by water from the cooling tower. When heat is required, the equipment is supplied with warm water from the condenser, while the evaporator

gets warm water from the cooling tower. By simply reversing the process of refrigeration, heat is obtained for the home. A switch controls electrically operated valves in the piping system, to which is connected the air-conditioning machinery.

FOLDING HIP BOOTS FIT POCKET TO AID SPORTSMEN



Hip boots, made of lightweight rubber, that can be folded for carrying in the pocket, are being offered to sportsmen. Built-in cleated soles and broad quarter heels give a sure footing on rocky stream beds. Fishing or hunting trip ended, the boots are rolled up.

Holtzer Lab at Thelme

Co. 25 Library

Waltham Roxbury Boston, Mass.

Converse Rubber

Co. Malden

Mass

Developed by Case School of Applied Science, Cleveland, O.

B796

B7837

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44

Cmt. James O. Lowell
212 N. 11th St

POPULAR MECHANICS

Lincoln, Neb



Autos Fight Grasshoppers with Insecticide-Filled Tanks, Top, and Electrified Screens, Bottom

ELECTRIFIED SCREEN FOR AUTO KILLS GRASSHOPPERS

Electrified screens, attached to the front of automobiles, have been found effective in the war on grasshoppers. The insects, aroused by the auto moving through a field, fly against the electrically charged screen and are killed. Another weapon in the hopper war consists of a tank, filled with water or kerosene and equipped with a bumper board, against which the hoppers fly and then drop into the tank.

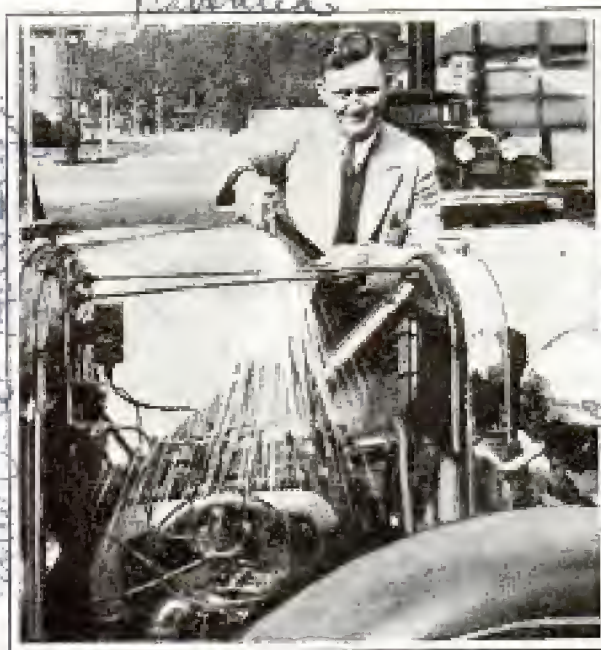
A NEW WORLD WITHOUT FIRE VISIONED BY SCIENCE

Fire, which has played so great a role in man's progress, will be needless to future generations because other natural forces will be utilized. This is the opinion of Dr. Walter Hough, chief curator of anthropology of the U. S. National Museum, who says the germ of this future phase of civilization already is developing in modern invention. Man has been the only mammal to overcome fear of fire, and had

he not adapted fire to his own needs, he might have been doomed to extinction. Not only did fire help man to survive by keeping him warm and helping him in his food problems, but it served likewise as light, aided primitive man in signaling and helped the farmer clear land. In later times, fire made possible the basic arts upon which civilization is founded, such as pottery making and the working of metals. As a result, millions of products touched by fire surround us since the coming of steel into modern technology. The name of Benjamin Franklin is one of the greatest in the history of fire invention, because he recognized the need for increase and regulation of draft, and has been called the father of the modern technology of draft because he compelled the fire to provide its own air circulation.

IGNITION IS MADE WATERPROOF BY PAINTING WIRES

Motors and ignition systems in automobiles, tractors, airplanes and boats can be made waterproof by painting wiring and terminals with a fluid now on the market. Water and gasoline will not wash off the liquid, its makers claim. Motors already stalled by wet ignition system can be started by applying this waterproof coating. The fluid is applied with a small brush to spark plugs, spark-plug wires, and to caps and battery terminals.



Turning the Hose on Your Auto Engine Will Not Stop It After Wiring Has Been Waterproofed

Ignition - the Products Co.
3423 Leavenworth Ave
Los Angeles, Calif

Made by Raymond Johnson
Stromfield, Neb

see Oct. 1931

Science Service
4/16/32

Washington, D. C.

no change

B3 685 Conl Walter B Lubson,
Suite 402, 201 N. Broad St
Phila

MENTAL MAGIC

By HARRY BLACKSTONE

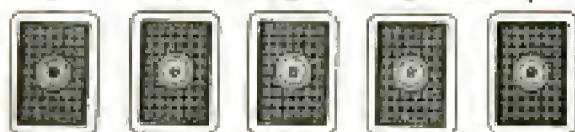
IN the field of impromptu conjuring, no tricks are more popular than those which appear to be a form of "mental magic." People, as a rule, are impressed by any ability which seems to involve the discovery of thoughts.

Let us begin with a prediction involving playing cards. Here, the magician arranges five heaps of cards. He writes something on a sheet of paper and gives the folded slip to a person to hold. Point-



SPECTATOR COUNTS

5 4 3 2 1



MAGICIAN COUNTS

1 2 3 4 5



FOUR
FIVES

FIVE
CARDS

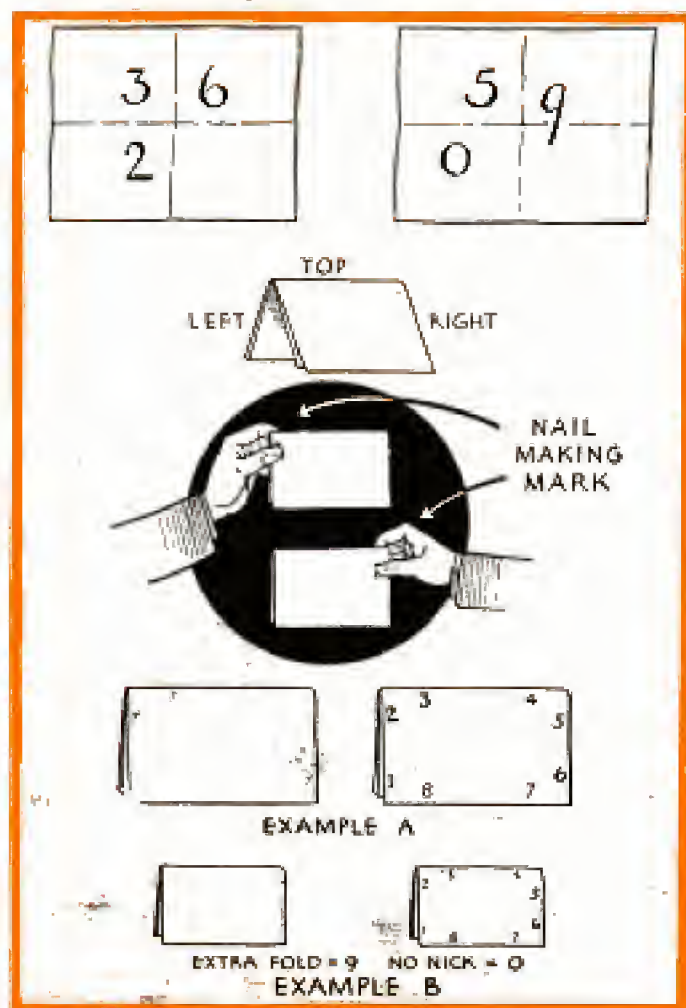
ADD TO
FIVE

ing to the heaps of cards, which are lying, face down, in a row, the magician remarks:

"Here we have five heaps, which may be counted from left to right. I have written the name of the heap which you are going to choose. Will you kindly indicate the particular heap that you desire?"

The person does this. The magician asks him to look at the heap. It contains the four five-spots from the pack. The paper given him bears the statement: "You will choose the 'five'-heap."

Thus the prediction has been fulfilled. This heap is the only one containing five-spots! But it is apt to work



differently each time. Therefore, the magician is prepared to make any heap appear to be the five-heap.

One heap contains the four five-spots. Another heap consists of five cards. A third heap has three aces and a two-spot; the end heaps about eight cards each.

If the heap with the four fives is taken, the cards are simply turned faces up, to show that the chooser has taken the heap of fives. If the heap of five cards is selected, none of the cards are turned up. Instead, the chosen heap is shown to contain five cards. Should the heap of three aces and a two-spot be taken, the magician shows that its spots add up to five.

If the heap at the magician's left is selected, he requests the spectator to count along the row, from left to right. The spectator, being opposite, naturally finds that the heap he selected is number five in the row. Should the heap at the magician's right be selected, the magician himself does the counting, indicating the chosen heap as number five.

The next problem involves colors and numbers. The magician takes an envelope from his pocket. He also produces four small cards of different colors: red, white, blue and black. He requests someone to write a number of three different figures on the envelope; to reverse the number and to subtract the smaller from the larger, taking the central figure in the answer.

For example:

$$\begin{array}{r} 826 \text{ (number chosen)} \\ 628 \text{ (number reversed)} \\ \hline 198 \text{ (answer)} \\ 9 \text{ (figure used)} \end{array}$$

"That number," says the magician, without looking at the answer, "will indicate the particular color which you choose. Select one of the colored cards!"

The spectator takes the white card; opening the envelope, the magician shows that it contains a dozen cards—and there are exactly nine white cards in the lot!

Here, again, the magician always wins. First, the central figure in the answer is invariably 9. The subtle part of the trick is the manner in which the magician makes the particular color selected indicate the number nine.

There are twelve cards in the envelope. The cards are arranged thus: white, red, white, blue, white, white, white, white, black, white, white, white. On the bottom side of the red card is inscribed the large figure 9.

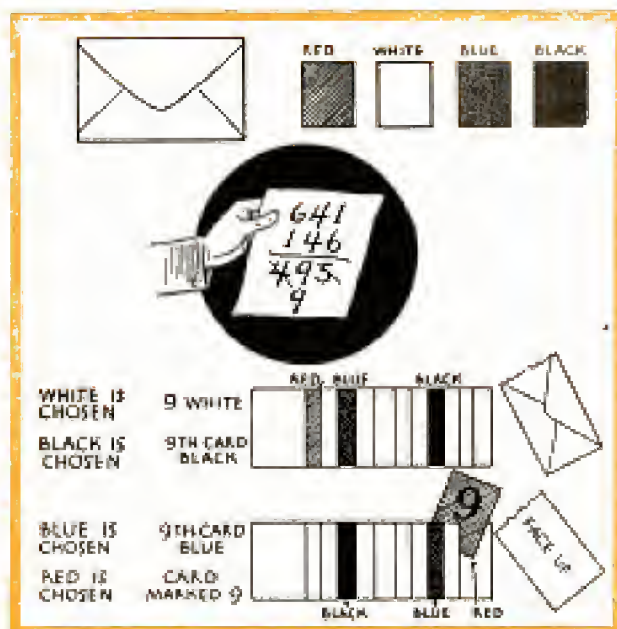
If white is the color chosen, the magician simply opens the envelope and counts out the white cards, showing that nine are present. If black is the chosen color, he counts down to the ninth card and shows that it is black! Should blue be selected, the magician turns over the envelope before opening. Thus when he removes the cards and counts down to the ninth one, it proves to be blue. Should red be the chosen color, the magician also turns over the envelope, but here he spreads the cards wide apart and finds the red one marked with the figure 9—the only red card in the lot and the only card that bears the selected figure!

Now for a cigaret test. The magician

begins by asking for three different types of cigarettes—all alike in shape. As he accepts one of each brand, he drops the cigarette in a hat. The hat is shaken and offered to the magician behind his back. Reaching in, he plucks out a cigarette, names it and gives it to someone. He repeats with the other two cigarettes. Right, every time.

Here is the method. The first cigarette, A, is dropped into the hat without any manipulation by the magician. The second, B, he takes by the center, between his thumb and second finger and gives it a roll as he drops it in the hat. The third, C, is taken by the end and rolled slightly at that end. The rolling action is imperceptible due to the motion of the hand as it drops the cigarette, but gives the magician his clue.

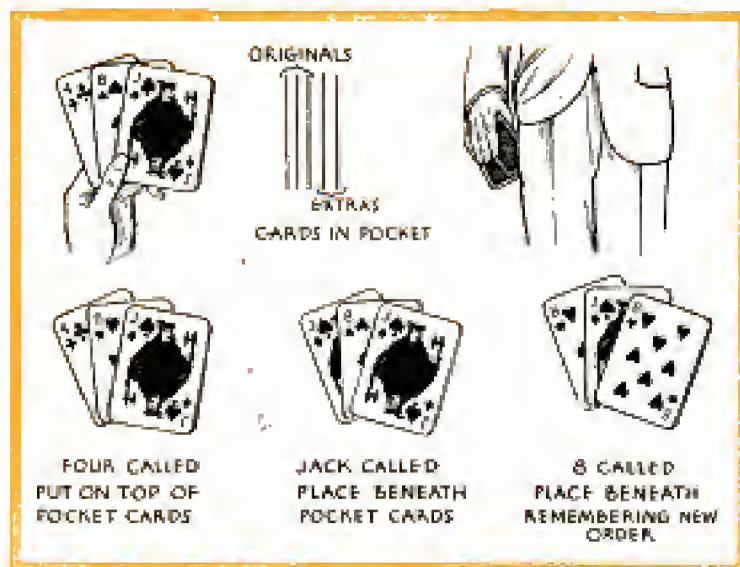
A very surprising trick of thought reading may be performed with three cards and worked upon several persons at the same time. The magician begins by showing three cards—say, the four of clubs, eight of hearts and jack of spades—and asks each spectator to concentrate individually upon a particular card. Then he puts the cards in his pocket. Going to person number one, he says: "I shall remove two cards, leaving the one you chose." He withdraws two cards from his pocket, keeping the faces toward himself. He asks which card the person chose. The answer is "jack of spades". Reaching in his pocket, the magician brings out the third card. It is the jack of spades. Replacing the three cards in his pocket,



he goes on to the next person and repeats the feat. He continues thus with all present—and in every case he brings out the card called.

Two duplicate cards are used—a eight of hearts and a jack of spades. These are already in the pocket—backs outward, the eight above the jack. The magician shows the three original cards and arranges them four, eight, jack, in a fan, toward himself. Each person is asked to remember a particular card. The three original cards are placed in the pocket, on top of the two already there. The first two cards that the magician withdraws are the bottom cards—the duplicates—which he keeps toward himself. In his pocket are the four, the eight and the jack, in order. Whichever is called for as the chosen card, that is the one the magician takes from his pocket.

If the four is the selected card, the magician casually shows all the faces of the three cards in his hand. He then puts the cards back in his pocket—upon the two cards there; and he is ready to repeat the trick with the next spectator. If the jack is the card called for, the magician brings it out and shows it, but he does not reveal the faces of the cards in his hand. Instead, he arranges the three cards jack, eight, jack and replaces them in his pocket, beneath the two cards there. If the eight is



B-685

called for, the magician simply shows the card he brings out last. But as he replaces the cards in his pocket, he arranges them eight, jack, eight and puts them beneath the two cards in his pocket. From then on, the order in the pocket must be considered as four, jack, eight, until the calling of the jack brings back the original arrangement.

Our final experiment requires the co-operation of two persons—the magician and his assistant. The magician stays in the room with the audience; the assistant retires. Taking a sheet of paper, the magician requests that three figures be written upon it—each figure different. This done, the magician folds the paper—along creases already there—and gives it to a spectator. The magician goes out one door and the assistant comes in the other. Holding the folded paper to his forehead, the assistant names the three figures.

It's all done when the magician folds the paper. Folded twice, the little slip has one long creased edge, or hinge, which

the magician considers as the top. The left side, all single edges, is considered as sections one and two; the top as three and four; the right side is five and six and the bottom is seven and eight, as shown.

The magician, of course, sees the figures written, for he is supposed to transmit the thought later on. As he folds the paper, he indents the edges with his finger nail, a mark for each figure. Thus one at the right of the top would indicate the figure 4. A nick in the left portion of the bottom would indicate 8. If 9 happens to be a figure on the paper, the magician indicates this by simply giving the paper an extra fold—folding it in half before he makes the marks. The assistant, knowing the size of the paper used, will recognize this instantly.

Zero is seldom used as a figure. If it happens to appear, the magician leaves no indication for it. As it was specified that three figures should be used, the assistant, finding only two indications, knows that the third is zero.

FOGHORNS THAT WEIGH A TON PROTECT SUPER-LINERS

B 514



Note Size of These Foghorns as Compared with That of Man Standing Near By

Protection for the German super-liners "Bremen" and "Europa" in foggy weather is provided by giant steam sirens, each of which weighs close to one ton. The foghorns are among the world's largest ship sirens, yet they show much less steam consumption than the usual type. Deep

notes, which are regarded as necessary for effective fog signals, are produced by the employment of four diaphragms in these sirens.

RUBBER CASE FOR FLASH LIGHT PROTECTS ELECTRICIANS

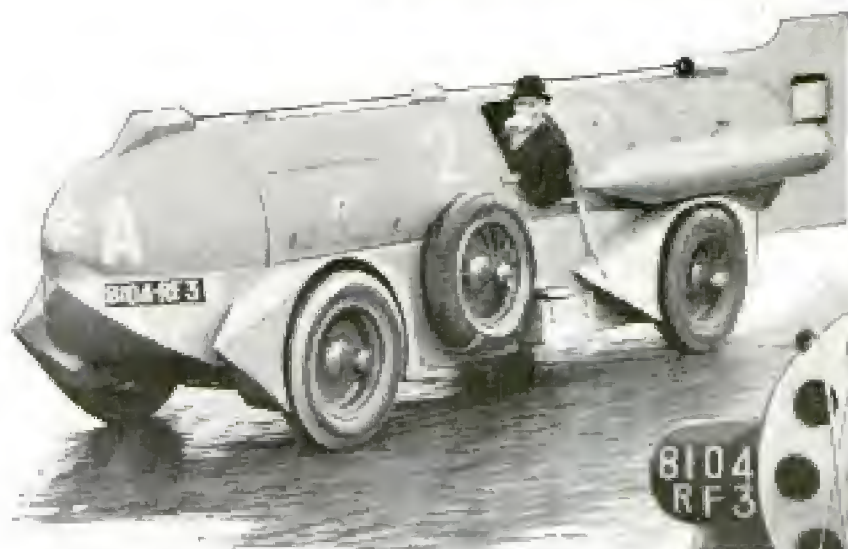
B 764

Through a process of rubber plating, all metal parts are insulated in a flashlight case for electricians and power-line workers. The insulation becomes part of the case and voltages as high as 29,000 have failed to penetrate it. The rubber also stands severe impact and abrasive tests. The case is available in two and three-cell sizes. There is also a hanger for attaching the light to the belt or a double clip will be supplied for carrying the case on the steering column of an automobile.



Carl Albrecht
Ingenieur, Kaiseralle 173-A,
Berlin. Wilmsdorf, Germany.

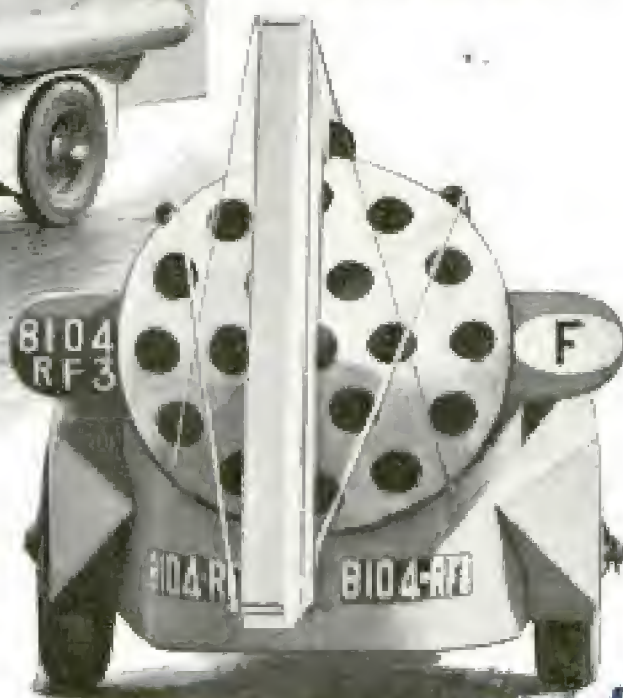
French Battery
Co. Machine
W. S.



French Racing Car Which Is to Try for World Speed Record; It Is Powered by Three Motors of 800 Horsepower Each

TORPEDO-SHAPED RACING AUTO TO TRY FOR SPEED RECORD

France's first serious bid for world speed records on land materialized recently when a huge racing car, looking like a torpedo on wheels, was given its preliminary tests preparatory to shipping it to the United States for an assault on the mark of nearly 254 miles an hour made a few months ago in Florida by Sir Malcolm Campbell of England. The French car, built by M. Stapp, an automotive engineer, looks a bit like Campbell's "Bluebird." It weighs two and one-half tons, is thirty feet long and is driven by three motors of 800 horsepower each. The exhaust escapes through holes at the rear and a big fin at that point deflects the flames. The designer calculates the speed of the racer at 360 miles an hour, over 100 miles above the present mark. In the first tests it made only seventy-five miles an hour as the engines were too new.



shoveled into the trough and is washed down the chute by a continuous stream of water. A riffle box that swings from side to side does the separating and may be removed to enable amalgamation of the gold grains with mercury. A one-half-horsepower motor runs the device for a whole day on one gallon of gasoline. The outfit is of such size that it can be packed into the back seat of an automobile for easy transportation to the workings

ONE-MAN GOLD SEPARATOR IS RUN BY MOTOR

As an aid to separating grains of gold from the sands of placer-mining sites, a one-man separator operated by a small motor is being offered to the army of prospectors now in the field. The machine is portable and self-contained, with a capacity of three-fourths to one ton of unscreened sand per hour. Gold-bearing sand or gravel is

Prospector Is Shown Shoveling Ore-Bearing Gravel into His Portable Gold Separator



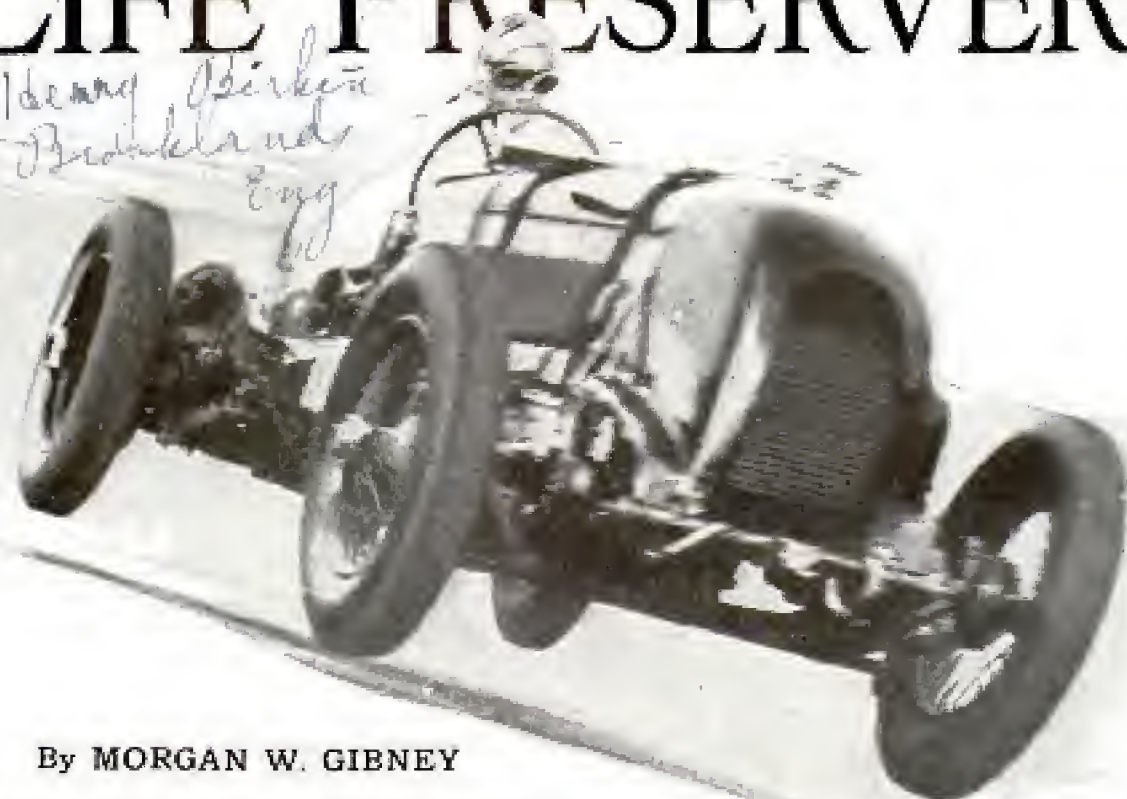
Mine And Smelter Supply Co.
1422-17th St. Denver, Colo.

B-934

*Directorate Tire &
Rubber & Chem
Ohio*

LIFE PRESERVERS

*Sir Henry Birken
at Brooklands
Eng*



By MORGAN W. GIBNEY

OUT in front of the pits of the Indianapolis speedway, Barney Oldfield was making last-minute adjustments on his car. Streaked with grease, omnipresent cigar cocked at a belligerent angle, the old master strategist was half concealed beneath the open hood, fingers flying expertly.

At length he straightened up and pulled the throttle wide. Instantly, the hoarse grumble of the idling motor rose to a shattering roar; smoke belched from the exhaust pipes in a blue-white cloud and the entire car quivered in protest. Onlookers edged away, fearful, but the terrific racket was music to Barney's ears. Satisfied, he "shut off." His cigar, always the barometer of his mind, shifted to "at ease."

"Well, Barney, all set for the big battle of speed?" queried one of his admirers.

Oldfield snorted. "Battle of speed—my eye. This is no speed event. Call it 'The Great Gamble of Tires.' You'll never see real speed till we get real tires. How can you keep your eyes on the road when you're watching your 'shoes' every minute of the race? How can you keep your mind on the traffic when you're wondering what minute a tire tread will wrap itself around your neck?"

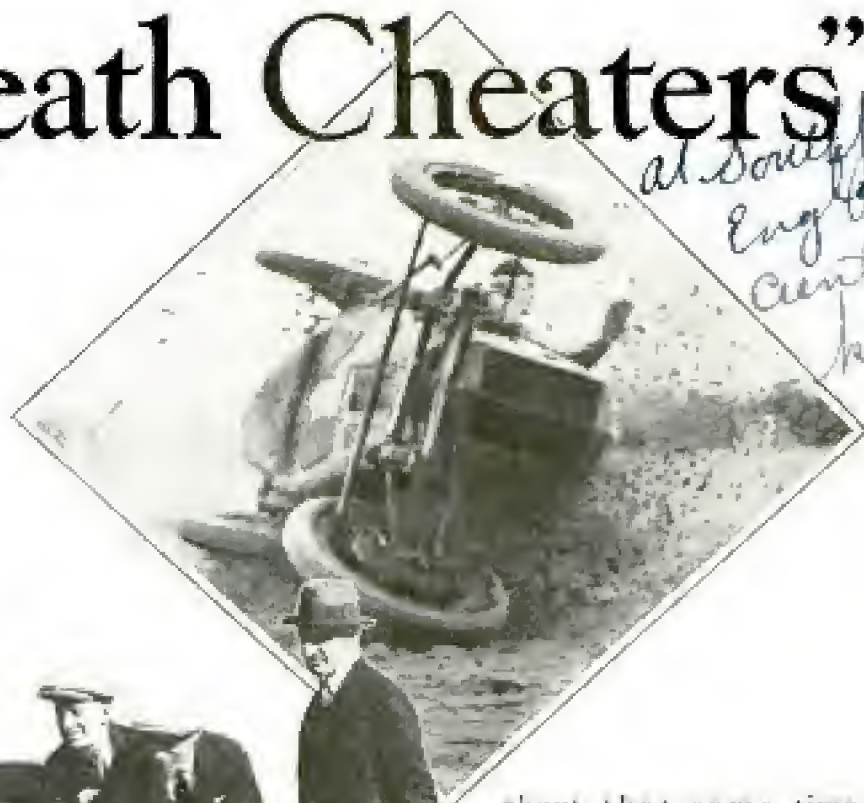
Barney turned toward the other drivers warming up their mounts. With a sweep of his arm he included the packed stands. "Death cheaters, all of 'em, whether they're running on the track or on the boulevard; and the best life preserver is a good tire. Some day we'll have real auto shoes and then you'll see family cars running faster than our race cars run now."

That was nearly twenty years ago. Barney's remarks became axiomatic: An automobile is no safer than its tires. And, it is because of the demands of that hard-riding fraternity that you now have tires that you can put on and virtually forget for a year, two years or more. Or, perhaps it might be more accurately stated that the speedway has been the crucible where, under the flaming lash of speed, improvements in tire design and tire building have been worked out to give you safe shoes for the car that carries your family.

Many modern motorists can remember the days when a twenty-mile automobile tour was a genuine adventure; when half a dozen spare tubes, spare casings, an assortment of patches and emergency blow-out boots were standard equipment for a

for the "Death Cheaters"

Right, Tire Failure on the Race Track Always Means Trouble—Frequently Disaster; Below, a Group of Famous Race Drivers Inspecting the First Balloon Tires to Make a Transcontinental Trip; Included Are Barney Oldfield, Tommy Milton, Benny Hill, Jimmy Murphy, Eddie Hearne, Ira Vail and E. Waldo Stein



*at Southport
England.
Cientiffe
killed*



about that same time, tires for passenger cars delivered about 3,500 miles of service. Now, the entire field of forty cars at Indianapolis does not use more than twenty spares and most of those changes are precautionary. Most of the first ten finishers run through without a change of rubber. Now, passenger-car tires deliver anywhere from 15,000 miles up—safe

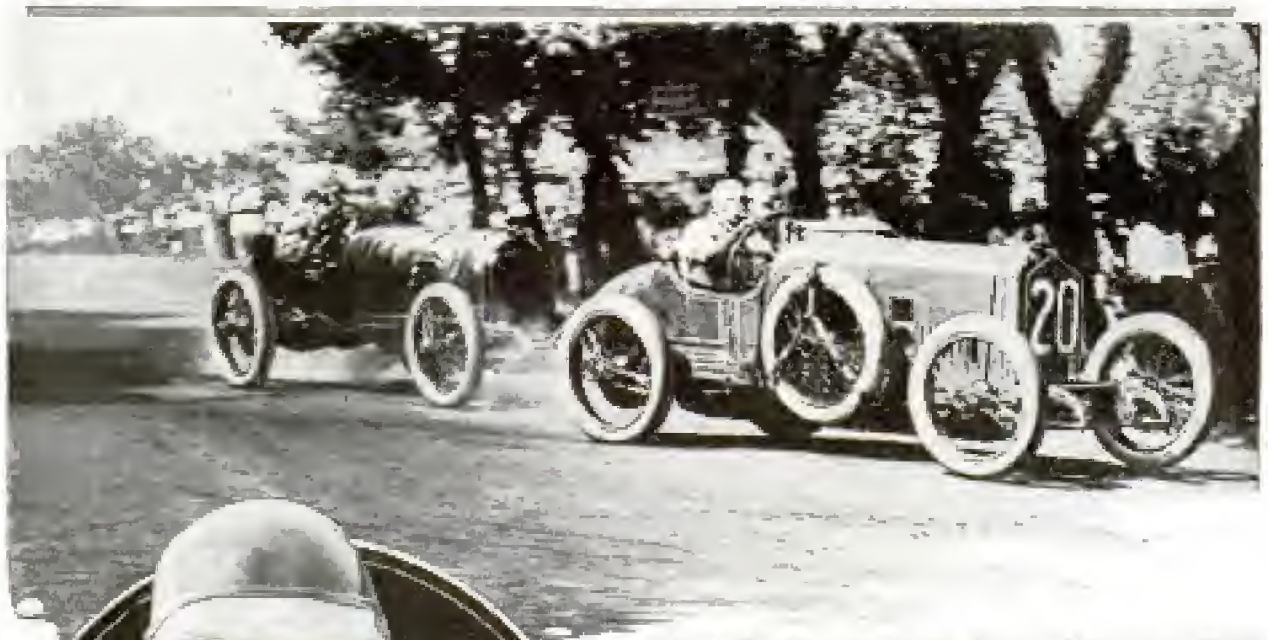
Sunday outing. It hasn't been so long since the time when, if you tasted the thrill of "stepping on it" and the speedometer swung around to forty, forty-five or maybe even fifty, someone was sure to caution: "Careful; suppose a tire should blow out."

Nowadays, family cars attain higher speeds than those which thrilled race followers a score of years ago—and with safety. The credit for this advance is due largely to the "guinea pigs of the automobile industry," the race drivers who took steering wheel and life in their hands to give the stands a thrill.

Back in Oldfield's racing days, it was not unusual for a car to burn up fifteen to twenty tires during a 500-mile race. At

miles. Not so many years ago, just before one of the big Pacific coast race meets, one driver refused an entire shipment of tires because the baggage man had tossed them out of the car door and allowed them to drop on the floor. The driver feared the tires might have been weakened by the jolt of the fall. Last year, Billy Arnold crashed through the concrete wall of the Indianapolis track at better than 100 miles per hour. The heavy steel rims were crushed at the point of contact, the spokes bent and twisted, but the tires which withstood the full brunt of the terrific blow were uninjured. They are on exhibit now in the Firestone plant, still holding their original air.

In the old days drivers used to "weath-



Above, Family Cars Attain Higher Speed than These Oldtimers; Left, English Racing "Crash Hat"



For the past decade, Firestone has been outstanding in racing-tire development, and for good reason. When Barney Oldfield quit driving in 1918, it was to go into the "tire end" of the racing game with Firestone. Three years later, his former racing partner, E. Waldo Stein, slid out from under the steering wheel for the last time and also allied himself with that organization.

But Stein didn't quit the speedway. This year he celebrates his twentieth anniversary at the tracks. Always a "tire driver," Stein is now Firestone field racing representative and probably America's best authority on racing rubber. He knows racing

tires. He can watch forty cars flitting past at speeds around 110 miles per hour and accurately diagnose the condition of every tire on every car. With a split-second glimpse, he can tell you whether the blurred fringe on that right rear is merely an oil spray flung off by the whirling wheel or the dreaded tread separation which might well mean disaster in a lap or so.

A car may have fought its way to the front of the pack, earning "heavy dividends" in lap prizes every round it holds its leadership. Yet a word from Stein and the pit manager will hoist the signal that yanks that car out of its hard-earned and lucrative position into



Cross Sections of Tires for Beach Racing, Track Racing and Passenger Cars; Note the Contrast in Tread Faces

er" their tires; bake them in the sun for days before a race. Whether this treatment actually benefited the tires is difficult to say. Nowadays, they merely "put 'em on and forget 'em."



On the Speedway or on the Highway, an Automobile Is No Safer than Its Tires

the pits for a tire change. No questions, no arguments—pitmen and drivers have long since learned that Stein doesn't guess; he knows.

You can't afford to make mistakes when you're dealing in high speeds. And, so, Stein has gone ahead cautiously. His data, as voluminous as they are carefully compiled, are turned over to Firestone engineers. Like metallurgists devising new alloys, they evolve new rubber compounds, new structural designs; always making sure that each departure from established practice is a genuine improvement. Then, back to the track for "the proof of the pudding." And, finally, on to the public for family cars.

In all the realm of sport, there is no personality to match the racing driver. He is indeed a "rara avis"—or he wouldn't be in racing. There is something of mechanical genius, something of the philosopher, something of the actor in every one of them. Only a few can win; only a few of the races pay enough even to winners to maintain their cars. The majority of drivers earn returns that an apprentice clerk would scoff at. Every one of them is ready to spend his last thin dime on his car and start out on the Indianapolis grind on an empty stomach. But every car matches the perfection of a fine watch. Some of them may have \$30,000 tied up in racing equipment—and lack the cash price of a hot dog.

What keeps race drivers on the roaring road is a question that not even a race



driver can answer. Look at a group of relief drivers clustered around a wrecked car that has just been towed off the track into the garage "alley." The car is a shapeless mass; its driver maimed, probably fatally. Dispassionately the relief chauffeurs look it over and decide it came to grief because of a snapped steering connection—something entirely beyond the



driver's control. In the midst of this post mortem a call boy rushes into the enclosure, grabs one of the men by the sleeve. "You're up." Without a word, the driver turns and starts for the track, adjusting helmet and goggles as he runs.

A moment later, he's skimming the oily-slick track at better than 100 miles per hour. For what?

Race drivers carry luck charms according to their fancy. Pete De Paolo carried his baby's first shoes. Tony Gulotta never drives without his lucky tie, patterned after the checkered flag. Practically all the cars carry emblems of St. Christopher, patron saint of transportation, rabbits' feet or some other talisman. Perhaps the most unusual of all was the luck charm of a foreign driver—a picture of his wife with her first husband on their wedding day. Curiously enough, the drivers insist that these luck pieces are not to charm off accidents but rather to carry them through to victory.

In the matter of tires, however, they will not trust to luck. It may be a surprise to some race followers to learn that drivers buy their tires and pay for them with good cold cash, even as you and I. Indeed, they wouldn't accept an unknown

or unproven tire even as a gift. They have learned, through dire experience, that tires may put them "up in the money"—and tires may put them out through the wall.

The extent to which racing has influenced passenger-car tire design is impressively demonstrated in the history of the balloon tire. Introduced in 1922-1923, the balloon tire was accorded a very cool reception. Motorists were afraid of it. It promoted shimmy. It produced a "high-speed float" most disconcerting to the driver. They feared what might happen in case of puncture or blowout and pooh-pooed the notion that a four-ply tire of low air pressure actually was safer as well as more comfortable than high-pressure tires.



Wreck of Arnold's Car in 1931 Indianapolis Race; Upper Left, Hitting the Concrete Wall Crushed the Wheel, but the Tire Stood the Shock

But Firestone engineers staunchly believed in balloons. Stein saw in them the logical solution to Indianapolis track—the roughest, crankiest and most treacherous track in American racing. So he and his associates pressed their development.

In 1925, the first balloon tires were brought to Indianapolis. Race drivers were openly skeptical. These fat "airbags" might be all right for leisurely boulevard travel, but for the rough brick surface of Indianapolis track—nothing doing!

Stein sought out Earl Cooper, a notoriously "heavy-footed" driver whose whole racing strategy was summed up in the idea: "Get out in front first and stay there."

"Just give them 'a breeze'," was Stein's plea. "Judge the 'ride' and 'handling' for yourself—and take my word that they'll



Oldfield Congratulates Sir Malcolm Campbell on His Record Sprint at Daytona Beach

stay with you." Whereupon Stein deposited a set of balloons in Cooper's garage and left the track.

Alone, Cooper decided to try them. He had them mounted on his car and went out on the track.

For a few laps he drove cautiously. Then he "opened up." Down the straightaway, supercharger screaming like a banshee, and on into the turn "wide open."

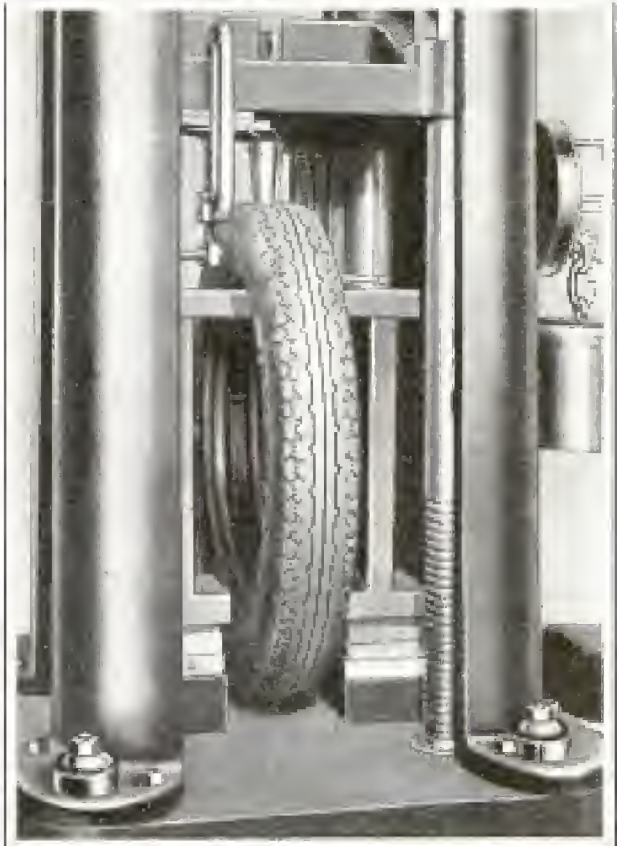
When Stein returned to the speedway, Cooper met him with a sheepish grin.

"Sold," was his only comment.

News of that ride, however, spread like wildfire through the garages and, on Memorial Day, most of the top flight of drivers rode on balloons. And, on that day, the speed record for the track took a jump upward. Balloon tires were "in." Not only were race drivers "sold" on them; automotive engineers in general realized their worth. Before the end of the year, practically all cars offered them as standard equipment.

Offhand, it might seem that the higher the speed, the more rubber required to stand the punishment. Actually, the opposite is true. Your family-car tires have a tread more than twice as thick as track tires. And, the tires designed to withstand the terrific strain of more than 200 miles per hour on Daytona Beach have a tread face thin as paper.

What does the future hold in the way of tire development? That's hard to say. So-called doughnut tires have recently made their appearance; an amplification of the balloon-tire principle. Will they be a success? You bet. For back of them



Measuring the Margin of Safety in a Tire Designed for Passenger-Car Service

lies the wealth of experience gained from thousands of miles of grueling mileage at breathtaking speed—provided by the "death cheaters" to whom tires are life preservers.

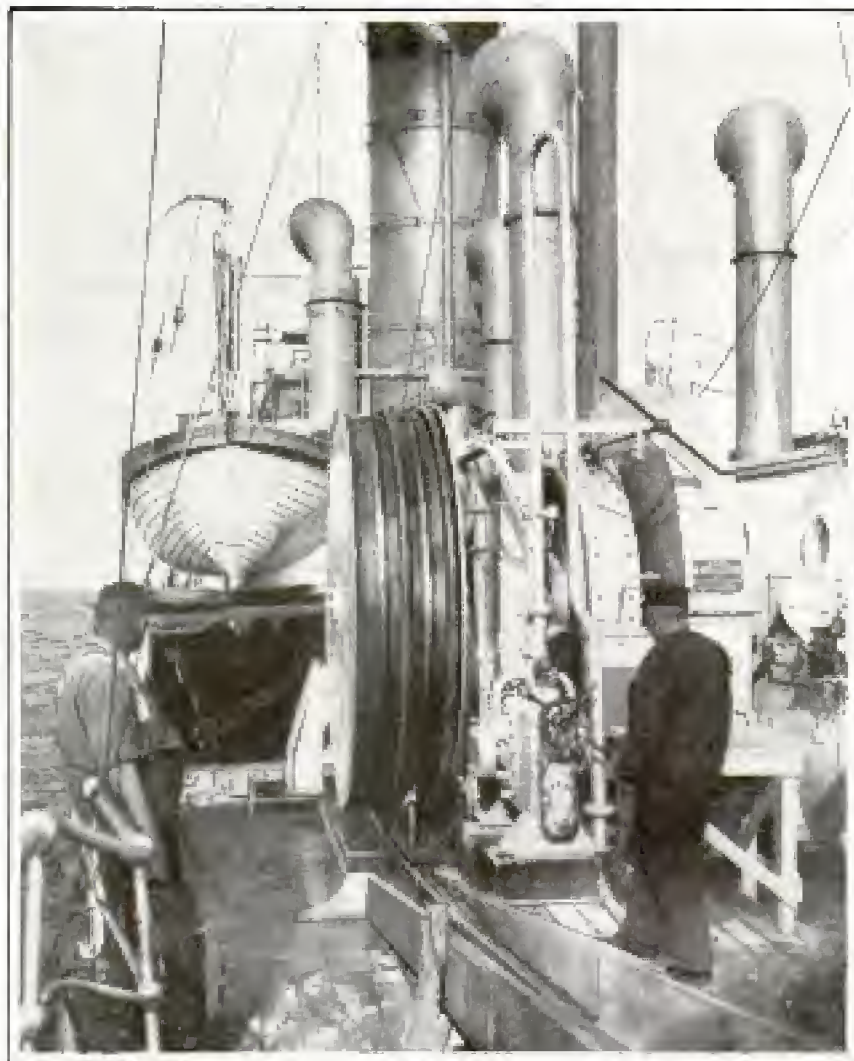
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POPULAR MECHANICS

Mr. Albert Neuburger New Winter-
feldstr. 24,
Berlin W 30
Germany

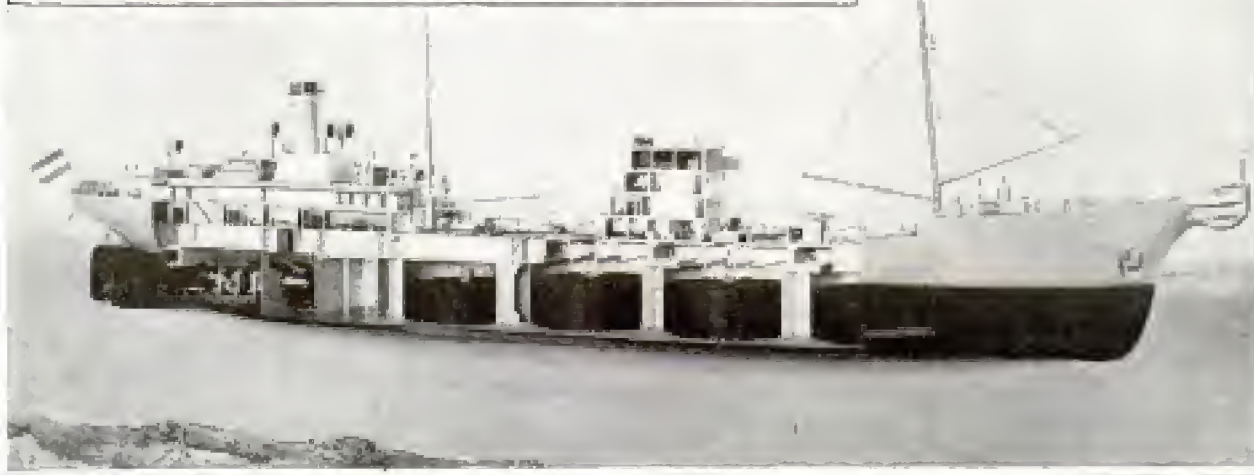
Cable-Laying Ship Is Floating Wonderland



with water to keep the vessel on an even keel. In addition to the cable rolls in the hold and unreeling equipment on deck, the ship has comfortable cabins for officers and crew.

FISH AS FAST AS EXPRESS TRAINS

Some fish can travel faster than an express train, estimates showing that the mackerel frequently attains a sixty or seventy-mile-an-hour pace. Considering its handicap in size, the mackerel is regarded as the champion racer, since it is known that the bigger the fish, the greater the speed, other things being equal. For instance, the tarpon's speed is estimated at eighty miles



Top, One of the Big Reels for Laying Cable from Ship Built Especially for That Purpose; Bottom, Cutaway View of Vessel Showing Huge Rolls of Cable in Hold; Note the Cabins for Officers and Crew

As wire for undersea telephone and telegraph lines is unreeled from huge drums in the hold, a new cable-laying ship sucks up water to maintain a balance. The hold is filled with enormous rolls of cable. As each roll is used, its compartment is filled

an hour, if it's in a hurry. The whale, while a mammal and not a fish, can travel faster than the fleetest ocean liner. However, science has not been able to determine the exact speed of fish, for obvious reasons, and can only estimate.

Everett Spring, 1997
Capitol St. Washington
D.C.

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B.F. Goodrich Co.
Akron, Ohio

3.539

**PUNCTURE-PROOF
TIRE CARRIES
NO PRESSURE**

It is impossible to puncture a new tractor tire designed for farm and industrial use, because the air inside is at the same pressure as that outside. The "zero-pressure" tire takes the place of solids and pneumatics, and possesses advantages over both. The construction consists of a rubber arch built on a perforated steel base. The arch is flexible enough to permit full tread contact under light loads, yet is sufficiently rigid to support loads greater than the capacity of the tractor. The tire will fit standard solid-tire wheels. Extensive tests have been made on Iowa rural highways and in the citrus groves of Florida.



Vest and Shoes for Traffic Officers Which Are Heated by Electricity When the Policeman Stands on Metal Plate Connected to Battery

**VESTS HEATED BY ELECTRICITY
KEEP POLICEMEN WARM**

Vests and shoes heated by electricity to keep traffic officers warm were successfully tested during the past winter. The vest is lined with thin strips of rubber, with electric heating units vulcanized inside, and the insoles of the shoes are similarly equipped. On the bottom of the shoes are metal plates from which wires run to the vest and the heating elements inside the shoes. The officer stands on a metal plate connected with a battery and when contact of both shoe and battery plates is made, the heating elements warm up within fifteen seconds. The officer is free to move about since no wires connect him with the battery or the plate on which he stands to direct traffic.

**HANDY FLOODLIGHT ON WHEELS
SPEEDS REPAIR WORK**

Repair work can be speeded up by a floodlight on wheels that leaves the mechanic's hands free. The light, with its cover glass protected by a wire guard, is mounted on a small three-wheeled truck that can be rolled under automobiles to throw a beam on the job.



Resting on a Wheeled Truck, This Light Can Be Pushed into Close Places

**BURSTING OF CRYSTALS ADDS
BEAUTY TO PAPER**

Chemicals which spread and form fantastic designs somewhat similar to snow crystals, now are utilized as a decorative coating for wrapping paper. When deposited, the chemicals seem to burst out in all directions, each unit crowding its neighbor and forming an over-all design in which there is uniformity yet absence of mechanical repetition as in printing or embossing.

General Electric Co.
in Schenectady, N.Y.

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B630 Cont. to W. Lray
Sparkhill, N.Y.

Is the UNIVERSE



Above, Reproduction of Sir Isaac Newton's Telescope. Made from His Own Drawings

By JAMES BRAY

"THE world's a bubble," said Francis Bacon four hundred years ago; and philosophers, poets and visionaries have been echoing the idea ever since. We accepted their words with poetic license, but scientists today are finding stark reality in the fantastic saying. Indeed, they report, it is to be taken literally. The whole universe of stars and star clouds is a vast bubble which is constantly expanding.

The most spectacular evidence in favor of this weird world picture came when Astronomer M. L. Humason, at Mount Wilson observatory, discovered two "island universes" speeding away at the incredible velocity of 15,000 miles a second.

That speed—900,000 miles a minute, 54,000,000 miles an hour—may be taken as an index of the rate of explosion.

If this were an isolated case, it might be taken as a freak and rated as a random

velocity in the stupendous maelstrom of stars and systems which constitute our physical world. But it is not isolated. It is only the latest in a series of ninety-one such bodies that have been measured.

Of these ninety-one island universes, eighty-four indicate that they are running away from our part of space at speeds which increase with their distances. The remaining seven registered a velocity of approach, but two of these gave so slight an indication that, with more refined measurements, the motion may be found to be a running away like that of the majority.

The island universes, which, because of their rotating pinwheel appearance, are known to science as spiral nebulae, are apparently independent systems. Each is believed to be a vast whirling circular swarm made up of millions of stars, some

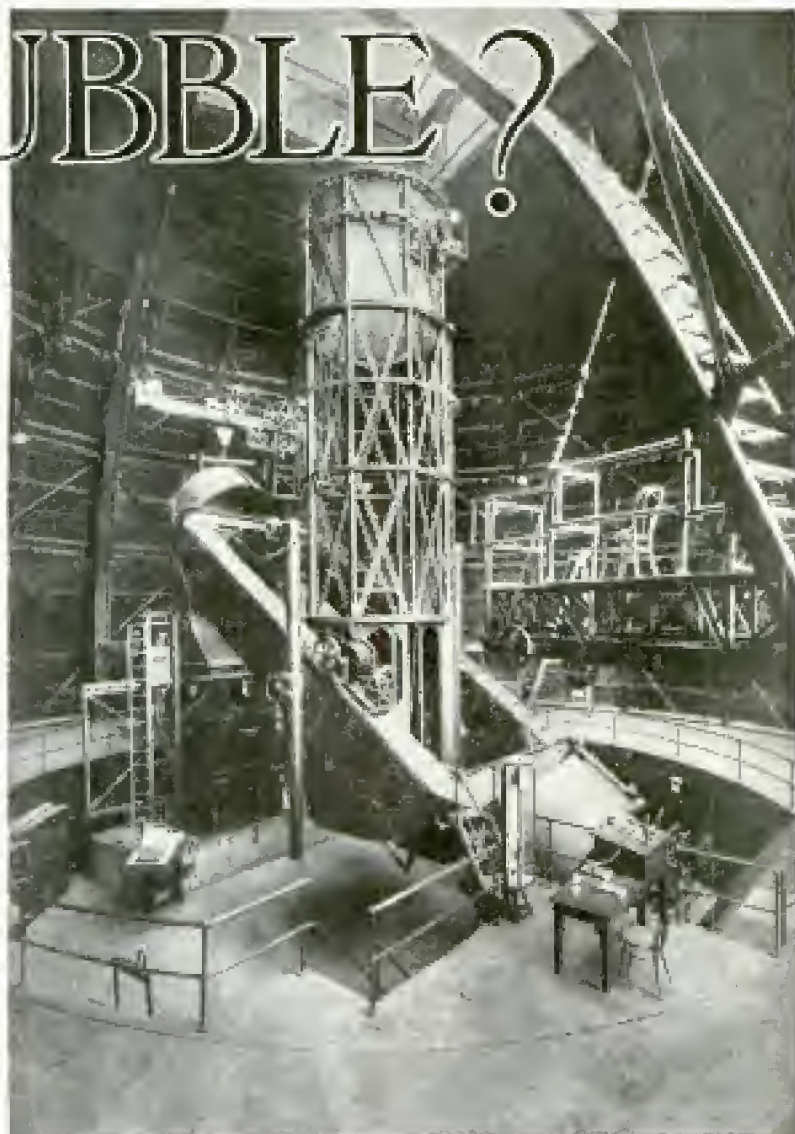
a BUBBLE?

what like the Milky Way in which our own sun is one middle-class orb among millions of lesser and greater lights. Indeed, to a watcher in one of these universes our Milky Way would probably appear as a spiral nebula.

Nebulae are not rare nor scarce. Indeed there are hundreds of thousands, perhaps millions of them, but most of them are so far away that in our largest telescopes they appear only as fuzzy spots of light. The millions of stars, after hours of exposure on the most sensitive photographic plate, are able by their mass effect to make only a hazy pinhead image on the photograph. Even the nearest of these bodies, the Great Nebula in Andromeda, is so distant that its light must travel 803,000 years to reach our telescopes. But that is just next door for an island universe, and we are able to get a comparatively close-up picture of the Andromeda spiral. When we photograph to distances of 100,000,000 light years, as the Mount Wilson astronomers have done recently, the picture becomes a faint speck that only an expert can decipher.

In 1917, Dr. William DeSitter, of Holland, predicted from mathematical computations that distant objects in space should show a runaway motion. At that time only three island universes had been tested with the spectroscopic speedometer; it seemed small evidence on which to base so revolutionary a prediction.

But presently more evidence began to pile up. Dr. V. M. Slipher, at the Lowell



View of Interior of a Modern Observatory, Showing Giant Telescope Now Used; Compare It with Newton's Telescope on Opposite Page

observatory in Arizona, set himself the task of photographing the outside systems and measuring their velocities. By 1922, he had "clocked" forty spiral nebulae, and thirty-five showed themselves outward-bound, hustling away from our part of space with a unanimity that seemed startling.

At Mount Wilson observatory, the enormous eyes of the sixty-inch and the 100-inch telescopes were turned on other spirals, and soon Dr. Edwin Hubble and Mr. Humason began to report findings that confirmed and reinforced the earlier picture of a scattering of the star systems in all directions. By the end of January, 1932, they had measured the velocities of forty-eight additional spirals and the unanimity of their flight was unmistakable.

While the speed of these runaways is



not uniform, one peculiar regularity was noted: The farther off the object is, the more rapidly it is receding.

Thus, the famous Whirlpool nebula, the first spiral to be discovered, whose distance is such that its light requires two million years to reach us, is running away at the comparatively leisurely pace of 175 miles a second.

Another spiral, in the constellation Virgo, which is six million light years distant, is withdrawing to the tune of 550 miles a second.

Still another, in the constellation Pegasus, distant twenty-three and one-half million light years, is traveling away at the rate of 2,400 miles a second.

Then there is a massive spiral which shines through the stars of the Great Dipper—it is seventy-two million light years away—and its velocity of recession is 7,300 miles a second.

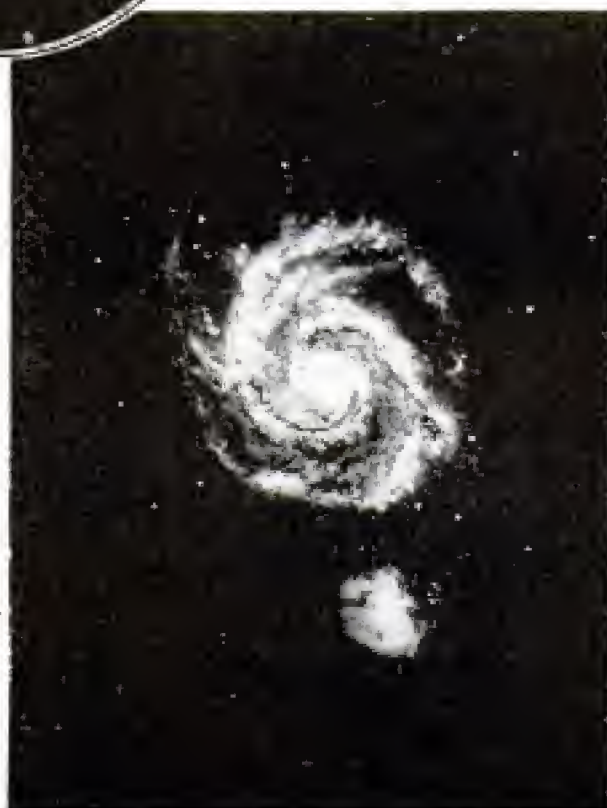
And so the scale of velocities goes up as the remoteness of the objects increase, until we come to the two faint nebulae discovered at Mount Wilson last January. Their position in the sky is in the direction of Castor and Pollux, the heavenly twins. The distance of the nebulae from the earth is 135 million light years. And their speed of recession is 15,000 miles a second—by far the swiftest speed yet re-

corded for any celestial body.

But what does this scattering flight of our neighbors mean? In 1930, following an astronomical conference in England at which this latest enigma of the stars was discussed, attention was called to a scientific paper that had been published back in 1927. It was the work of Abbe George Lemaitre, a priest and scholar of the University of Louvain, who has devoted his life to mathematical studies. In this article, Lemaitre analyzed the problem of the runaway nebulae and proposed the amazing solution that space itself

was expanding and carrying everything with it.

This revolutionary idea, which pictures the universe as a gigantic growing bubble, is the sensation of the day in astronomy. It has been hotly debated and has withstood criticism to a remarkable degree. Einstein has been compelled

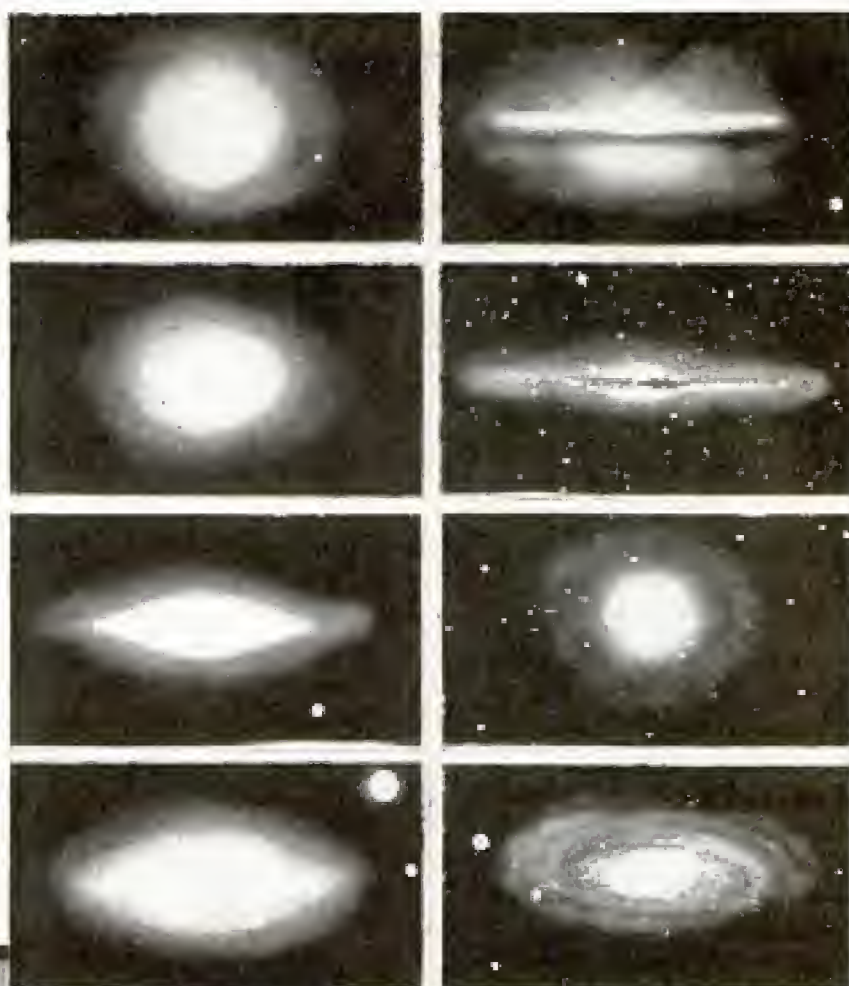


Top, "Island Universe" Nearest Earth; Center, the "Runaway" Universe; Below, Famous "Whirlpool" Nebula

to modify his theory of the universe as a result, and in March last he said, "I believe the apparent motions of the nebulae away from the earth are real."

From the observations, experts are able to estimate the size and substance of the universe. Sir Arthur Eddington estimates from the present rate of expansion that the universe is doubling its diameter about every 1,500 million years, "and its size will go on expanding in this way in geometrical progression forever," he adds.

But, say the geologists, how can this be? For, according to the testimony of the radioactive rocks, the earth itself is at least 2,000 million years old.



Above, Sequence of Shapes into Which Nebulae Can Be Arranged; Below, Celestial Speedometer Which Dissects Light of Stars to Measure Their Velocity

And, say the astrophysicists, the sun is far older than the earth, its child. Indeed, Sir James Jeans has figured the probable age of the sun, and gives it as seventy million million years.

How can the whole universe be younger than its children, the sun, the earth and the other planets and stars?

This is the enigma that science is puzzling with today, and it looks forward with added keenness toward the day when

the new 200-inch telescope, now under construction, will be ready for use. For the new instrument will reveal objects that are four times as faint as the faintest that can be photographed today. This means that with the new instrument many of the remote spirals now dimly seen will be brought to measurement, and that many even more remote, and not seen at all now, will be revealed with light enough to betray their velocities. For the news of these incredible speeds is brought by the starlight,

the fragile rays which have traveled millions of years to reach our instruments.

ELECTRIC VAPOR DISPELS FOG

By spraying fog clouds with vapor charged with electricity, the atmosphere can be cleared, according to a German inventor. A ship equipped with such apparatus would be able to clear the atmosphere 3,000 feet ahead of its bow.

Mr. Wigand
Proc. Hamburg
Hamburg, Germany

B810

Carl Joseph Nease
c/o The Star-Herald

62

POPULAR MECHANICS

Pasadena Calif

Back-Yard Railroad Makes Money for Boy

the top of an eighteen-foot mast, made of two-inch pipe. At the top of the pole are collector rings which contact with brushes mounted on the swinging boom, sixteen

George Henick, Director of Industrial Arts in Pasadena Schools

Constructed at a cost of only \$40, an electric railroad is being run on a money-making basis by its three-year-old operator in the back yard of his California home. Three complete turns of the 120-foot oval track constitute a ride which costs one cent. The line was built by manual-arts students of John Muir Technical high school in Pasadena, and is operated by the son of the director of industrial arts of the Pasadena schools. A quarter-horsepower motor, costing \$8, powers the locomotive, and castings for the wheels, axles and truck assembly were \$7 more. The cab of the locomotive will accommodate a boy twelve or fourteen years old and is entered by lifting the hinged top. The car body is forty-nine inches long, fifteen inches wide and twenty-eight inches high. The frame and body cost \$4. The car stringers are of oak, one and one-quarter by one and one-half inches, and the cab is covered with three-eighths inch three-ply pine, with the roof sections, front and rear, and the pilot made of twenty-eight-gauge galvanized iron. Wires are run from the house-current supply to



Electric Railroad Built in a Back Yard at a Cost of \$40 Which Is Making Money for Youthful Operator at a Cent a Ride

feet in length, and to wiping brushes attached to lead wires which run along the swinging boom and drop down to the car's trolley. This assembly cost \$9. Power from the electric motor is transmitted to the wheels through gears. There are really four gears in the assembly, one on the motor, one on the axle and two intermediate ones. Inside the cab, fourteen inches wide, twenty-six and one-half inches high and thirty inches long, is a double-throw switch, enabling the motorman to go forward or backward at will at a speed of four miles an hour. The cast-iron wheels are four inches in diameter; the axles, of

B474 Cmt. Fraichy
 Coily, 986
 63
 Pennsylvania St
 Denver, Colo

POPULAR MECHANICS

cold-rolled steel, are one-half inch in diameter, and the ten-inch-gauge track of mild steel, three-sixteenths by one and one-half inches, is set into grooved red-wood ties. The track cost \$9, and the ties, one and one-half by one and three-quarter inches, cost \$3. Several similar lines are being constructed by high-school students, and instructors claim any mechanically inclined boy should be able to build such a road.

Cmt. Fraichy
 Coily, 986
 63
 Pennsylvania St
 Denver, Colo



Segregator Which Separates Water from Gasoline Installed on a Tractor; It Is Intended Particularly for Use on Airplanes to Make Flying Safer

DEER GIVEN WITH AUTO BOOMED BUSINESS

Deer given away as a premium with the purchase of each car for \$500 or more have brought a miniature boom to an enterprising merchant in a Nevada town. Having seventeen deer raised on the outskirts of the famous Kaihab national forest that overhangs the northern rim of the Grand canyon, he conceived the plan of offering one free with each sale. The plan worked so well that more deer were required, so that the rearing of deer may become a necessary sideline to this dealer's future business.

John Cashman, Fairview



Deer Lot of a Nevada Automobile Dealer Who Offered an Animal Free with Each Car Purchased

WATER IS WRUNG FROM FUEL TO MAKE FLYING SAFER

Just adopted as standard equipment by the army air corps, is a separator, for installation on planes, refueling trucks and storage tanks, that removes the water from gasoline. It is the invention of a sergeant in the experimental engineering section at Wright field, and the only moving part of the apparatus is a delicately adjusted float that sinks in any liquid of a lower specific gravity than water. Any unusual influx of water causes the float to rise and allow the water to flow directly through the chamber and escape. Water in minute quantities is trapped in the bottom of the chamber until its level is high enough to actuate the float. Baffle plates prevent the inflow of a mixture of water and gasoline in volumes too great to be separated. The largest model thus far developed delivers 150 gallons of pure fuel a minute, while others are small enough to install on the feed line of an airplane or automobile. It is said the separator is so sensitive that it can be made even to separate cold water from hot.

master sergeant

In the body of the average human adult, there is enough carbon to make more than 9,000 lead pencils.

Cmt. Len Black
 527 St. St.
 Las Vegas, Nev.

for many

Super-Zepp to Have All Luxuries of a Liner

Carl. Heiss & Kutschbach, Schwanauhofbergery
Strasse 6, Berlin, Germany

Smoking Room of the Huge Zeppelin Now Being Built in Germany to Carry Fifty Passengers

Arrangement of Cabins and Quarters in Two Decks; the Ship Will Be Over 800 Feet Long, or Twenty-Two Feet Longer Than the "Graf Zeppelin," with a Displacement of 6,700,000 Cubic Feet, and Inflated with Helium

Promenade Deck and Lounge: the Dirigible Will Be Driven by Eight Engines, Two Motors Being Installed in Each of Four Gondolas, Which Will Be Connected by Transverse Passageways

Robert H. Rose, Park
Naturalist, National
Park Service

13-522 John B.
Williamson, Manager

POPULAR MECHANICS

SUN HOLES SET SEEDING
TIME FOR ANCIENT
INDIANS 13.795

When rays of the rising sun of
March 7 struck a third wall after
passing through small holes in
two other walls of their watch
tower, ancient Indians of the
southwest knew it was time to
plant their crops. When



B533

Cont. Sec. Fr. Panel.

Ch. 1409. 537

Chicago

NEW FACES



Robert H. Rose, Park
Naturalist, National
Park Service

B-522 John B.
Williamson, Manager

POPULAR MECHANICS

Structural Engineering Corp

SUN HOLES SET SEEDING TIME FOR ANCIENT INDIANS

When rays of the rising sun of March 7 struck a third wall after passing through small holes in two other walls of their watch tower, ancient Indians of the southwest knew it was time to plant corn and other crops. When the sunlight reached the same spot on October 7, they began the harvest. That is the picture drawn of the sun-hole calendar found in ruins left by the Casa Grande tribes, who tilled the soil of Arizona long before the discovery of America by Columbus. Only on those two days is the sun in the right position to send its light through holes in two thick walls, across two rooms and to a marked spot on a third wall. Leap year, the phenomenon occurred one day earlier. The Indians are believed to have timed their planting and harvesting festivals by this calendar, which is ranked with famous devices for reckoning time by the sun used by the Egyptians, the Mayan Indians and the ancient Britons.

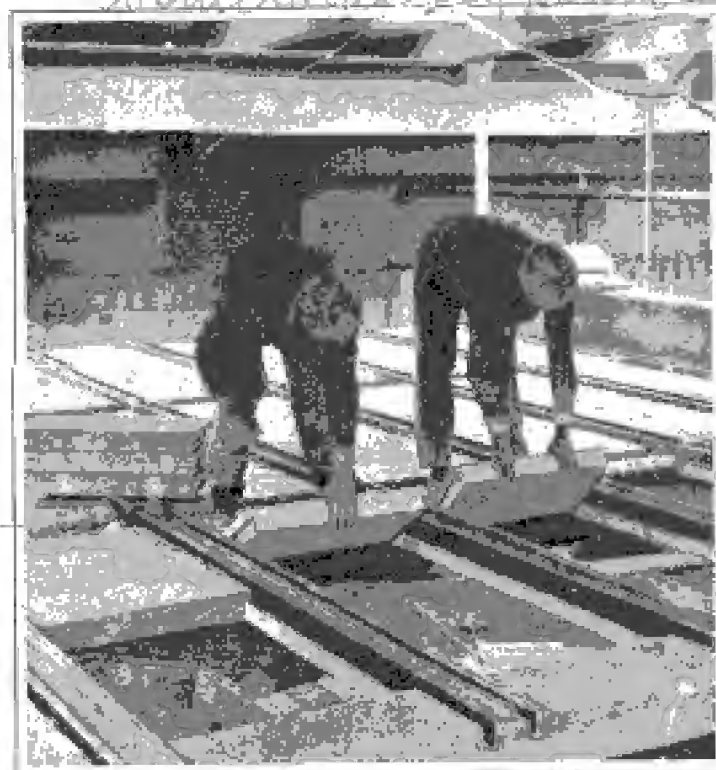
WAXED WRAPPER IS RAINCOAT FOR DAILY NEWSPAPER

Some newspapers are being delivered incased in raincoats in bad weather. Delivery boys tossing papers on doorsteps and porches are often careless, with the result that the paper is wet and soiled when the customer gets it. To keep it



Newspaper in Waxed-Paper Container Which Keeps It Dry Even Though Delivered in the Rain

clean and dry, waxed wrappers are provided and the papers are delivered in the waterproof containers.



Laying Slabs of Gypsum on Steel Beams Preparatory to Pouring Concrete on Top to Form a Fireproof Floor

FIREPROOF FLOOR EASILY LAID WITH SLABS OF GYPSUM

A new and much more speedy method of laying fireproof floors has recently been developed for office buildings, hotels, skyscrapers and other architectural types where concrete is utilized. Between pairs of steel I-beams, slabs of gypsum, cut to length, are laid and the concrete poured on top. The construction has the advantage of being not only fireproof, but speedy and requiring little expert attention in preparation for the concrete.

HOME MICROPHONE IN NURSERY IS KIDNAPING GUARD

Every sound in the nursery can be heard in other parts of the house if a home microphone, designed at first as an amusement device, is installed near the baby's crib and connected to loud speakers in other rooms. Tests of the mike show it to be excellent protection against kidnaping, for footsteps, sounds of raising a window, the child's whimpers, and other noises, could be heard in the living room, bedroom or wherever one of the loud speakers was in use. The mike also can be connected to the standard radio set.

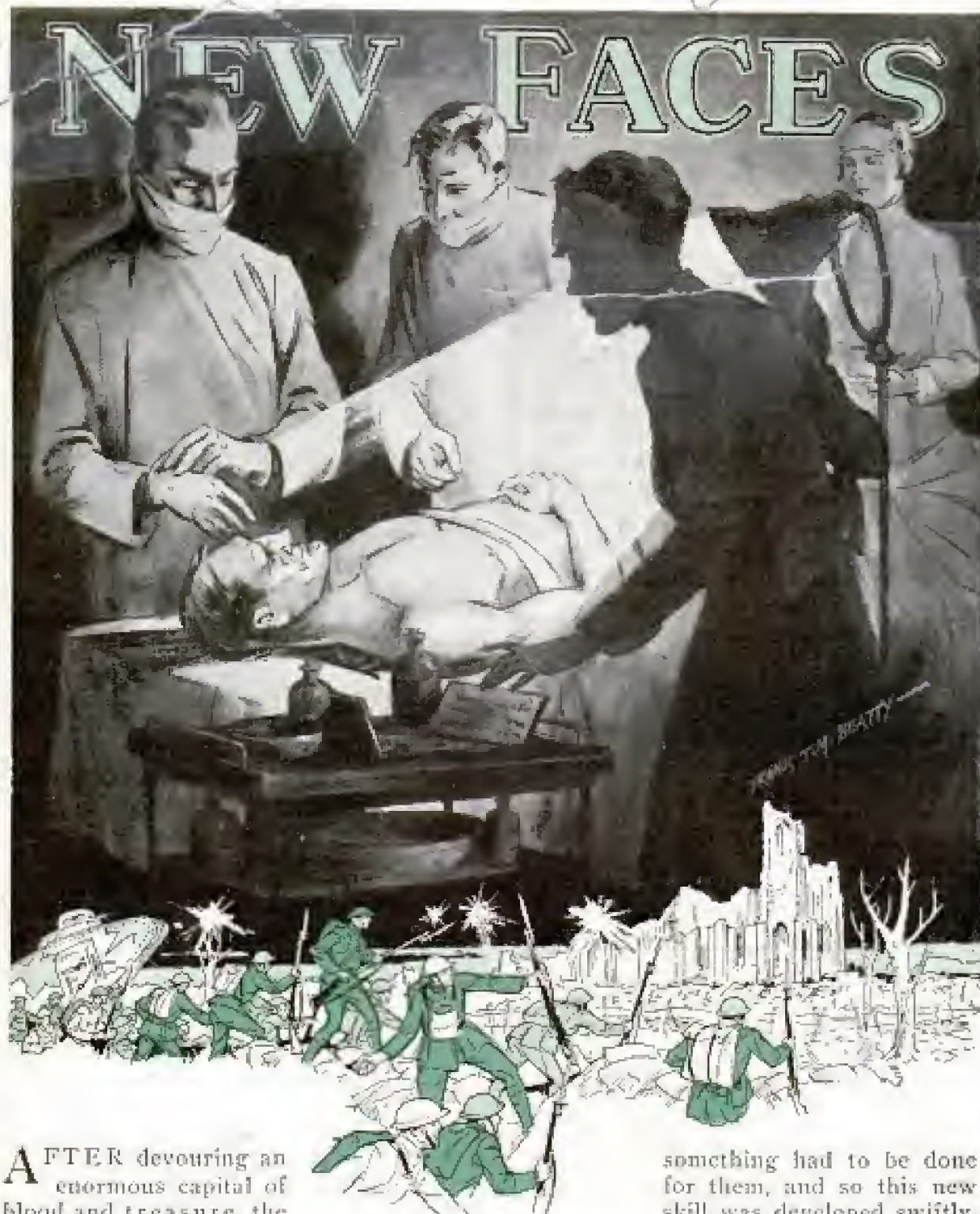
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Los Angeles Times

B533 Cmk. Sec. L. Paul.
R. 1409, 537 S Dearborn
Chicago



AFTER devouring an enormous capital of blood and treasure, the war has been paying back to humanity thin but accumulating dividends in the form of a new craftsmanship of the surgeon which is called plastic surgery.

Comparatively little was known of this art before the war. Then, as soldiers of Britain, France, Germany and the United States began to accumulate behind the lines in hideous formations of living dead,

By **BOYDEN SPARKES**

something had to be done for them, and so this new skill was developed swiftly. Sculpturing in living tissue had advanced to an astonishing degree by the end of

the war. When they took off their army uniforms it was already clear to the newly developed specialists in plastic surgery that their work was directly applicable to the relief of disfigurements met with in civil life.

Some months ago from the middlewest

for OLD

there came to the office of a plastic surgeon a young man who had fitted himself for the profession of teaching. In his adolescent years an infection, starting in his teeth, had made it necessary to remove much of his lower jaw. In a futile effort to conceal the deformity, he had grown a mustache. This, with his lack of a chin, gave him a grotesque likeness to that comic-strip character Andy Gump. Although entirely sympathetic and fully aware of his teaching ability, the educational authorities in his town dared not give him a job. They told him as tactfully as possible they feared he would not be



and further information



Above, This Is the Latest in Scalp-Treatment Apparatus—a Steamer to Replace the Old Hot-Towel Method, and a Hair Drier of Electrically Heated Cylinders; Left, Cleaning the Eyes Thoroughly Preparatory to Applying a Pair of Artificial Lashes



Paris, France

able to maintain discipline in a class of high-school boys.

"I made a new jaw for that man out of a piece of his hip bone," the surgeon said. "Bone grows and regenerates itself so the hip was not permanently weakened. Indeed, now it is as strong as ever, and the jaw is a substantial member of his face.

Artificial teeth completed the job. Today he is anything but chinless. His face has the strength of Mussolini, and he is making a fine record as a teacher."

The formation of new lower jaws, mandibles, by bone grafts to replace others destroyed by accident or disease has been accomplished many times since the war.

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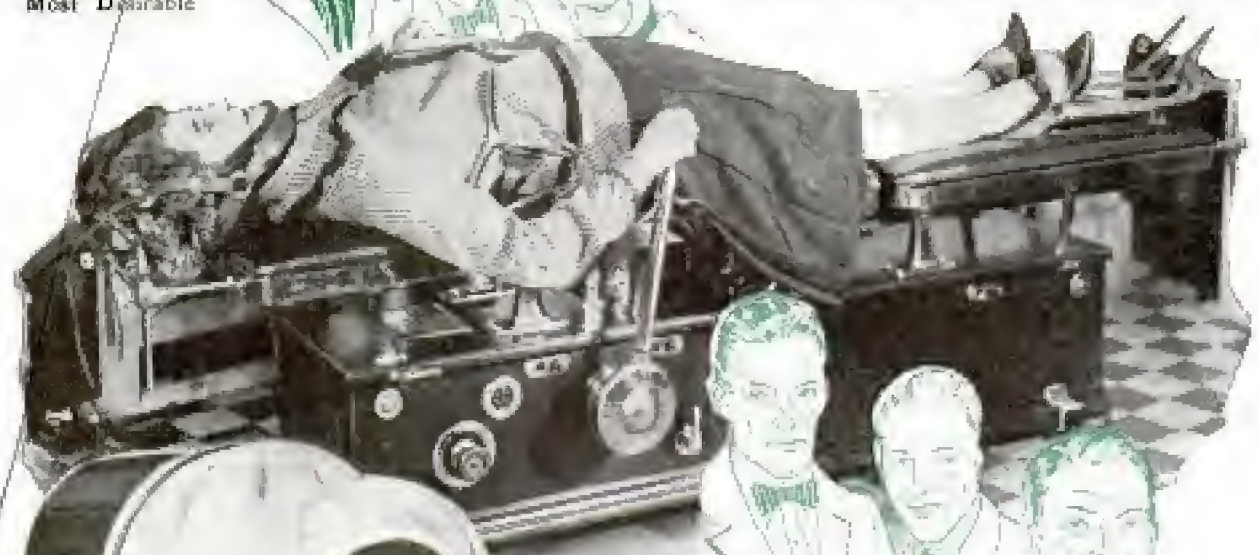
no information on electric machines

The Electrical Stretching Machine—a Boon to Short, Slender People; It Acts to Stretch in Length or Width. Whichever Seems Most Desirable



fragment. French surgeons rebuilt his face so skillfully that the new jaw afterward withstood the savage pounding inflicted in many later ring battles.

A great many of the miracles of facial surgery are wrought for the



Left, Vapor Generator for Applying a Turkish Bath to the Head Alone

hand power stretchers. no further info. Pandemicator Co. E 40 St. And Portland. Cleveland Ohio



purpose of making some afflicted individual capable of facing the world boldly, of removing a very real handicap in the way of getting a job.

Recently a reconstructive surgeon told of a legitimate application of his skill to damaged beauty. We sat in his office library amid souvenirs of his medical-corps service overseas. The question that started him talking was about a talented actress who was one of his patients. Months ago, she was badly burned by the explosion in her country home of a gas water heater. At the time fears were expressed that she could never again appear before the public.

"She will return to the stage," he said, "and be as charming as ever. Her hands are still sensitive to the touch, so that when she greets you, she offers an elbow to shake instead of her hand. Time will correct that. Her face was terribly burned. All the skin peeled off. On her cheeks there were places where the skin was gone right down to the flesh—third-degree burns. Actually I did nothing but give

A great many thousands of Americans have seen the result of one of these triumphs of plastic surgery. Eugene Criqui, French prize fighter, who won the feather-weight championship of the world from Johnny Kilbane in 1923, only to lose it a month later to Johnny Dundee, had such a jaw. In the fighting at Verdun, the lower part of his face was torn off by a shell

nature every chance to repair the damage.

"Aiding nature was almost a horticultural problem. Nowadays we scarcely ever put dressing on a face wound; we never, as a gardener would say, fertilize it. What damaged skin needs above all else is sunlight and open air. We humans have been a long time learning what all animals seem to know instinctively—the healing value of sunlight. In this case, the tiny islands of cells reproduced themselves until only a small area was left deeply scarred."

None of the men from whom I sought information are beauty doctors. All of them uttered solemn warnings that the beauty doctors make extravagant and unsupported claims as to what can be done. "God," said one of these doctors earnestly, "will always be able to make a better face than any surgeon. Never-



Madame Pompadour coiffure.



Top, a Coiffure That Was a Long Time in the Making; Below, Mud Pack Applied to Face and Hands

theless there are many victims of accident or disease hiding mutilated faces from the world whose appearance we might correct if given the chance."

The whole field of skin grafting is an amazing activity. There are two usual methods. A free graft is the outright



transfer of a piece of skin to cover an area that needs the replacement. In what is called pedicle grafting, one end of the skin is left attached to draw the nourishing benefits of blood and lymph from the body until the other end has become rooted at the place to be repaired. Often these sections, in tubular form,

are migrated step by step from one part of the body to the part that is to be healed. As one end becomes rooted in an incision



A Rejuvenating Machine Which Completes a Process of Peeling Old Skin from the Face, and Restoring a Skin of Fine Texture

and manifests health, the other end is cut free and swung nearer the goal.

A remarkable case about which I was told was that of a fairly common type of the patients who go to plastic surgeons for relief. This man's head had been jammed through a windshield in an automobile accident. His nose was flattened, an eyelid was so drawn in healing that the red lining was exposed, and most of his lower lip was gone. Today he has a good, rugged countenance. The lip was replaced from skin from his arm. A vermilion border was provided by a section of the lining of his mouth. Only faint scars remain of his original disfigurement.

The rebuilding or re-creation of noses

is among the commonest operations the plastic surgeons are asked to perform. They call these undertakings rhinoplasty. Rhinoplasty has an ancient history. In India, much more than a thousand years ago, there were men who could make a passable nose by grafting a flap of skin from the forehead. As a rule about two months is required for the job. The cost ranges from \$250 to several thousand dollars.

"None of us has ever built a really satisfactory ear," I was told by a surgeon lately. "So far, the best we have been able to do has been to make a pretty good ear. A while ago one of my colleagues made a new ear for a policeman who had lost one in a motorcycle accident.

"A piece of rib cartilage was carved in a thin likeness of the existing ear. This was planted upside down under a flap of skin high up on the policeman's shoulder. When the skin had grown fast to the cartilage the policeman appeared to have an ear growing on his

back. Next a pedicled flap was formed, a tube of skin with the ear growing at the end. This fabricated ear was swung up to the site of the missing ear and, until it had grown fast, was nourished through the tube of skin still attached to the shoulder. When this was cut away, the job was finished. The policeman had a new ear."

The successful plastic surgeons have crowded waiting rooms. One told me he performed about 700 operations last year, many of them charity cases. Half a dozen of his patients in recent years have been gangsters. Each came seeking the removal from his cheek and chin of a livid S-shaped scar, the mark with which the underworld brands those of its kind who

become too garrulous under the questioning of the police.

In a western prison some time ago, the warden decided that convicts who had served their terms were genuinely entitled to present a new face to the world.

A man who had completed his second term for robbery first brought about that warm-hearted attempt to give ex-convicts an even break.

"Why don't you go straight this time?" the prison official had asked, "You've paid a stiff penalty so far—ten years."

"Warden, are you telling me? I counted the minutes in those years."

"It's up to you, Jim."

"Is that so, Warden? With this pan I might try to take Bull Montana's movie job away from him, but that's my only chance. With my flat, broken breezer and these windmill ears I'll be arrested the first time somebody has a wrong thought."

The result of that conversation was that the convict spent another two months in prison, this time in the prison hospital as a free man. When he emerged, the doctor had adjusted his ears so that they lay close to his head and his nose was straight.

ONE-PIECE LIGHTING BRACKET FITS ANYWHERE

Cast as a unit, an aluminum bracket for indoor or outdoor electric lights is being offered to reduce the time and work of assembling parts. Different types of reflectors fit into the bracket, which is espe-



Light Bracket, Cast in One Piece, Eliminates the Work of Assembling Parts and Wiring

cially adapted to lighting of farmyard, private-garage grounds and similar places.

Quadrangle Mfg. Co.

32 S. Peoria St. Chicago



Setting Lever at a Number Frequently Called. Makes Telephone Connections without Dialing

CALL MADE WITHOUT DIALING ON AUTOMATIC PHONE

Calls can be made automatically by attaching a Frenchman's invention to the ordinary telephone. Fifty numbers frequently used by the subscriber can be called without using the dial. The invention resembles an oblong box, with two levers, one working in a slot that divides the box in half and the other at one end. One lever is set at the number to be called, while the other completes the operation of ringing.

BIRDS TRAINED TO CATCH FISH FOR ORIENTAL MARKET

Cormorant fishing, once regarded as a sport, now has been commercialized by Chinese and Japanese fishermen. Fishing is done at night, the "bait" being a basket of fire suspended from the boat to attract the fish. Each boat carries a "crew" of fishing birds which are tethered by cords. Through long training they become proficient in diving into the water, seizing fish and returning them to their masters, a good bird sometimes catching as many as 300 fish in one night. Because the cormorants work best when hungry, and to prevent them from swallowing marketable fish, each wears a ring of woven fiber around its neck adjusted to prevent the passage of commercial-size fish yet allowing the bird to swallow minnows.

Chas. Kenneth P. Wood

110 N. 4th St. St. Paul, Minn.

cannot locate. 8/29/32

M. Boye Paris.

with holder and globe \$3.25. \$2.50-2.30

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Germans Build with Light as Well as Stone



Actually building with light as well as stone, concrete and brick, German architects have developed a new sort of construction art in Berlin. When the building is erected, lighting effects are studied in relation to form and mass, instead of leaving the floodlighting or art effects to be installed after it is completed. The contrast between the dark and the lighting effects gives each building a distinctive and modernistic appearance. Not only have architects taken up the artistry of light to excellent effect, but outdoor advertisers have adopted the new medium as well, some of the oldest and largest firms of the city being among them.

CLOCKS THAT ARE NEVER RIGHT GIVE WORLD CORRECT TIME

Clocks that are always wrong keep the world's most accurate time. They are the timepieces in the new clock vault, a double-walled cellar with doors like an ice

box, sunk in the ground at the United States naval observatory in Washington. The clocks regulate the radio time signals from Arlington, by which millions of Americans set their watches daily. Although the clocks are "wrong," this does not affect the accuracy of the signals,

because they are incorrect by only a few hundredths of a second, and each night astronomers at the observatory check the time as shown by the clocks with the time as shown by the stars, then make allowance for the error percentage when the signals are sent out. The clocks always will be "wrong," because they never will be reset. Inside the vault they will tick undisturbed in a temperature that never varies more than one-tenth of one degree from eighty degrees Fahrenheit, with pendulums swinging in an atmosphere that virtually never varies, and safeguarded from outside vibrations and disturbances. Resetting the clocks would cause more trouble than allowing continually for the

Cleveland Plain Dealer

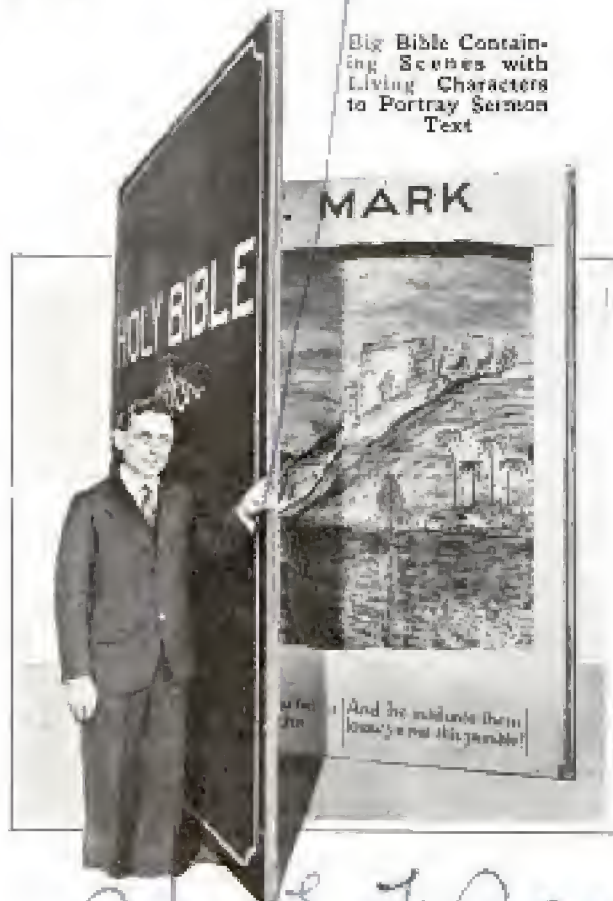
4/11/32

POPULAR MECHANICS

rate of error, because, should someone enter the vault, his mere presence would disturb the heat, pressure and other conditions sufficiently to affect the clocks themselves, and this would upset the error calculations. As long as they tick on undisturbed, the rate of change is constant, and the errors can be computed with great exactness. The clocks are run by electricity, and windows in the vault walls and a periscope into the vault from above enable an examination of the time-pieces without entering the quarters. The average error in time signals is less than one three-hundredth of a second.

BIBLE HAS LIVING CHARACTERS TO ILLUSTRATE SERMONS

One Cincinnati pastor illustrates his sermons by using a giant Bible with living characters. The book is eight feet wide, ten feet high and four feet deep and stands upright. At the beginning of the service the Bible is closed. It is opened as the passage for the sermon is read, and reveals a scene to illustrate the text with living characters portraying the principal parts.



Big Bible Containing Scenes with Living Characters to Portray Sermon Text

Balloon Tire for Wheelbarrow Prevents Damage to Lawns and Gardens



WHEELBARROW ROLLS EASIER ON BALLOON TIRE

Balloon tires for wheelbarrows not only protect lawns and flowerbeds, but in heavier work are less fatiguing to the gardener. The wheel and tire are supplied in one unit to replace the usual iron-tired wheel.

BALLOON THEORY OF UNIVERSE HELD SIXTH BIG DISCOVERY

In listing the important contributions to science, Sir James Jeans, British physicist, names the balloon theory of the universe as the sixth big discovery. This theory holds that the universe is swiftly and perpetually expanding, like a balloon or soap bubble being blown up. And since this expansion is pushing out the theoretical limits of space, objects in the universe are said to be moving away from the earth, as well as away from each other. Sir James says that we cannot be sure yet, but to all appearances, objects at almost inconceivable distances from the earth are moving away from us at a speed of nearly 1,000,000 miles a minute. The other steps in scientific progress are listed as: announcement by Copernicus that the earth revolved around the sun; publication by Newton of the law of gravitation; Darwin's "Origin of Species"; the discovery of electricity, and Einstein's theory of relativity.

Rev. E. J. Andree
Westwood M. E. Church
Cincinnati Ohio

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St James House, St. James St.

Sight Unseen

Secret Inks in International Intrigues



IN a laboratory hidden under the eaves of a building in old Greenwich village, New York, a shaded lamp silhouetted three figures. Two men in uniform, a woman in black, gathered around a drawing board upon which was tacked a sheet of paper. In the circle of light it shone—creamy, smooth, heavy, the finest private stationery. But upon its surface not a word, not a mark.

Strange then, the tenseness of face and figure of the three who bent over that blank sheet. Stranger the eagerness with which the woman gripped pencil and notebook, as one of the officers stretched his hand into the lamplight. He held a small stick, around which was wrapped a bit of cotton, stained brown. This the officer drew carefully across the paper, where it left a trail of rich sepia.

The three bent still closer, then, with quick intake of breath, stared at one another with amazed triumph. For etched upon that brown background, as in white fire, were letters, words. Almost immedi-

ately they began to fade, but not before the woman had copied them. When she had, they brought a chill of horror.

They revealed that, somewhere in New York, was a German woman spy, writing her chief in Berlin to send her an altar, with holy figures made of plaster—and in that plaster was to be concealed a powerful explosive!

Cunningly she had tried to hide her footsteps. She had discarded her real name and title and posed as a Frenchwoman,



Mme. de Vussiere. Repeatedly she had changed her hiding place. Her progress she had reported in secret ink, made by soaking in water a silk scarf that the chemists of the German secret service had impregnated with a special fluid. Before writing, she soaked the smooth, heavy paper with a weak ammonia solution, then pressed it for an hour. After writing, she

sponged the paper with the same solution, then pressed it for twelve to sixteen hours longer.

Now, this mysterious fluid that her scarf bore, was one of the highest developments of the German secret-ink experts. It was called "F" ink, and so cleverly compounded, that only one reagent would develop it—an iodine tablet, dissolved in vinegar.

But experts of the American secret-ink laboratory, and Dr. Juliana Haskell, of the mail censorship, solved the mystery, read the hidden messages and helped catch and convict the most dangerous woman spy in America during the World War.

Reading these letters was one of the outstanding accomplishments of American chemists in secret service during that war, but not the only one. They tested for secret inks an average of 2,000 letters a week; and discovered more than fifty important spy letters, which resulted in many arrests, and saved the country, our army and navy from many hidden dangers.

In such plotting, secret or "sympathetic" ink has always played a part highly fascinating and dramatic, but to most people as darkly mysterious as the plots themselves. The same mystery shrouds even the origin of these intriguing concoctions, although we do know that the Greek Histæus shaved a slave's head, tattooed a message on it, let the hair grow again, and sent the slave to tell a fellow conspirator simply "Shave my head."

The first real sympathetic ink came in the seventeenth century—lead acetate, developed by hydrogen sulphide. Yet today, 300 years later, the average reader knows that secret ink is any fluid, writing in which is invisible until developed by heat, light or chemical action—and knows little more. No wonder, for those who use such ink are mostly spies, criminals and diplomats—close-mouthed gentry. So, while the best secret ink today is believed to be the four-chemical compound of Doctor Bayle, that the French secret service uses, they, and they alone, know what are the four chemicals. The last fifteen years have seen greater progress in the science of secret inks, than the previous three hundred.

Our own secret-service laboratory in Washington learned how to turn out clever imitations of the passports and credentials of any country in the world, with seals and stamps complete, faked by clever rubber imitations and watermarks imitated by glycerine. Secret laboratories could and did imitate printed matter of all sorts. The French and most others faked photographs. The British imitated German newspapers and books, concealing beneath familiar exteriors the poison of propaganda or spy message.

Like the rest of their secret service, the British secret-ink laboratory was especially clever, and, in the first days of the war, won a great triumph that influenced its whole course. That was thanks to the chief of the German naval secret service, who, back in 1910, had accompanied the kaiser on a visit to London, to cover a check-up on his spy system in England. At night, he visited a German barber, named Ernst, in the Caledonian road—to the delight of his English shadows. They found Ernst to be what secret service terms a "letter-box" forwarder of secret-ink instructions and reports to and from all twenty-two of the German admiralty's spies in England.

Thenceforward, the British secret service read all this correspondence, then passed it along. That continued for four years, until August, 1914, brought the war. Then the spies were gobbled up, the German navy's eyes blinded. So the first they knew of the movement of transports bearing across the channel 100,000 British troops, was when their Uhlans bumped into them, in Flanders, with results that upset the German plans and helped win for the allies the great victory of the Marne.

If those Germans had been blinded, the British they met had not been; thanks again to the secret-ink experts. As anyone may see today, who goes to the British war-office museum. There displayed is a copy of a Belgian newspaper of that same fateful August, when a bedraggled Belgian refugee delivered to a British secret agent a pair of shoes, wrapped in that newspaper. The war office threw away the shoes, but kept the newspaper. Partly burned, daubed in grease, it looked useless and harmless. But the chemists found upon it what they sought—the slender trail of their spy's secret writing in lemon-formalin ink, running through the grease, leaping across the burned hole—a complete table of the German troop trains and their loads, that had passed through Liege until a day or two before. So, as the British took the field, they knew almost exactly what strength opposed them.

For that British stroke, German chemists were soon retaliating, displaying what seemed to their opponents the most diabolical ingenuity in developing one new ink after another. When the war began,

the average spy used simple, handy fluids: lemon juice, milk and water, saliva. But soon allied chemists took keen interest in the toilet articles found on captured German agents. No matter if the bottles were labeled with druggist's and doctor's name, the contents apparently innocent. That made them, to the allies, more dangerous, for if pressed, the spy could drink them. Even cakes of soap showed, on analysis, ferrocyanide of potassium. Finding these tricks discovered, German chemists evolved another, that for a time worked all too well.

First, they devised sympathetic inks that were quite colorless. Then they soaked in these inks, and dried, handkerchiefs, socks, underclothing and other articles such as are passed over in customhouse searches. Yet once past such an ordeal, the spy need only dip his medicated sock or handkerchief into warm water, then squeeze it, to have secret ink wherewith to write his reports. The British caught a spy because of stains on his necktie which turned out to be a silver preparation. At the French frontier, a woman was nabbed whose starched petticoat had sketched upon it, in invisible ink, tracings of

important French fortifications. The Italians got a spy at Canobbio, who carried two kinds of reagents, one positive, one negative. Soon allied frontier guards were not only testing the linen of all suspected spies or messengers but even their skins. On that sometimes fair surface, a chemical bath occasionally brought out secret writing!

However the spy might exult at successfully running the gauntlet, his very use of sympathetic inks brought danger. For he must keep with him, not ink alone, but special equipment for writing with it. The pens must not scratch the surface of the paper, so must be blunt, often ball-pointed, of gold or aluminum and, before using, should be held in a candle flame. Paper should be coarse and porous, with double coating. Before writing, it should be bathed with water, then dried with a linen cloth. If the ink used had been derived from gelatine grains, then to make it invisible, a wad of cotton soaked with

ammonia must be passed over the sheet. Such writing was developed by holding it over a saucepan of boiling water, or a current of gas,



The Germans once contrived a white chemical pencil for writing on a special linen paper of purplish shade, which instantly absorbed the marks, leaving no outward trace. If the recipient carefully charred the paper in a flame, the characters appeared very clearly on a black background. But spies did not like the ingenious pencil. To be caught with one meant death. So with other well-known paraphernalia of the secret writer's art. One German spy was brought to confess, simply because careful search revealed in the lining of his coat, a single ball-pointed pen. That was every iota of evidence—but it was enough.

Another such find enabled British secret service to score off its German rival a particularly impish yet effective trick. The British postal censorship found secret writing on the margin of an apparently harmless newspaper, mailed from Deptford to Amsterdam, which was one great letter box for Germany. The hidden message was that "C" was going north, and would report from "201." Only one street in Deptford boasted a number 201, and there Scotland Yard found one Hahn of German descent. But he was a British subject, and had nearly convinced them of his ignorance of "C," when searchers found hidden away, first the telltale ball-pointed pen, then a bottle of secret ink. Evidently, Hahn was letter box for "C," forwarding his reports. But who was "C," and where?

Hahn remained mute, so Scotland Yard questioned neighbors. They told of a Mr. Mueller who had visited Hahn just before leaving for Newcastle. In Newcastle they found him and returned him to London. There he was shot in the Tower, but not

before he had confessed, and divulged his whole method of working and the cipher that he used to report to his superiors. So for some time after his death, the British secret service kept sending to the same address in Amsterdam, written on newspaper margins, in the same secret ink,

signed "C," all manner of misleading information. In payment for which, the Germans sent to "201" fully \$2,000 before they discovered that something was wrong. And with the \$2,000, the British bought an automobile which they christened "The Mueller."

This grim drama shows the danger that lurks always for spies who, confident in their own secret laboratories, forget that there are others. For example, that Hungarian baron in Switzerland who forwarded to Vienna shipments from



Italy, of fruit wrapped in tissue paper, bearing messages written in milk, to be read by holding against the light. The Italian secret service removed the wrappers, substituting others with deluding messages. A prominent Swiss woman got into difficulties because she shipped into Germany large quantities of eggs, some of which were found to bear writing in an ink of tithymalus, a sort of euphorbia, developed by dipping the eggs into a solution of gallic acid.

Another and different woman, the French heroine-spy, Louise de Bettignies, once smuggled a message with consummate cunning, from Lille to London, through the German army. She drew a complete map of the German fortifications about Lille. This she gave to an assistant, who was an expert penman. Working with a microscope and delicate pen, he copied it, with invisible ink, upon translucent pa-

per, then pasted the paper neatly over the lens of an eyeglass. Louise put the glasses into a spectacle case, which she carried unsuspected through countless guards, to a British co-conspirator waiting at the Dutch frontier.

In the intense competition of such a war of brains, many new secret inks were developed, and much additional knowledge gained, some of which remains still secret. But besides those already mentioned, the following can be listed among sympathetic inks: Cobalt chloride; dilute sulphuric acid; copper acetate, and nickel chloride.

All of the above may be developed by heat, carefully applied. The amateur experimenter can get especially satisfactory results from the use of cobalt, which gives a brilliant blue writing easily revealed by heat, but not too much heat, lest the writing decompose. Cold air will make it disappear again. Three other sympathetic inks

are: sulphide of potassium, developed by lead acetate; pyrogalllic acid developed by copperas, and gold or tin in nitrohydrochloric acid.

During most of the war, iodine vapor proved a useful reagent, although allied chemists are said finally to have found something better, perhaps the British "red fluid." But iodine's numerous powers are no less valuable because most of them have been known since the Indian mutiny, when the vapor was used to bring out concealed writing in rice water.

Iodine vapor will show the indentations made upon paper by a dry steel pen or a special glass one. It will make paper that has been moistened and dried, as some spy letters were, bluish-violet, and will show



erasures in dark brown. It will also reveal parts of paper that have been brought into contact with chemicals, which is useful not only in secret service, but in detecting alterations in deeds, wills, etc., even though efforts have been made to hide the alterations with gum, gelatine, starch and flour paste.

Even in peace time, the spy and his master, the diplomat, use secret inks. Our own war-time laboratory in the war college at Washington has been closed, but in New York City, not so very far from a conspicuous memorial to our victory in that war, it is averred that there flourishes another such laboratory maintained, not by our own government, but by another with which we are at peace.



Wide World

Interiors of Air Liner: Top, Soft Cushions in Lounge; Below, Looking through Smoking Cabin to Pilot's Compartment

LUXURIES FOUND IN AIR TRAVEL ON HUGE U. S. PLANES

Many luxuries for the air traveler are found on the huge U. S. planes "American Clipper" and "Caribbean Clipper." Seats are down-upholstered, a buffet is equipped with electric grill and ice box for serving meals, a smoking compartment is available, and the ladies lounge is well-fitted.

METAL IS DANGEROUS POISON

B. 745

Thallium is apparently a poisonous metal and its use in human medicine and in wholesale poisoning of rodents should be restricted until more is known about its action. This warning has been sounded by Dr. Marcus Ward Lyon, Jr., of South Bend, Ind., and a similar warning was is-

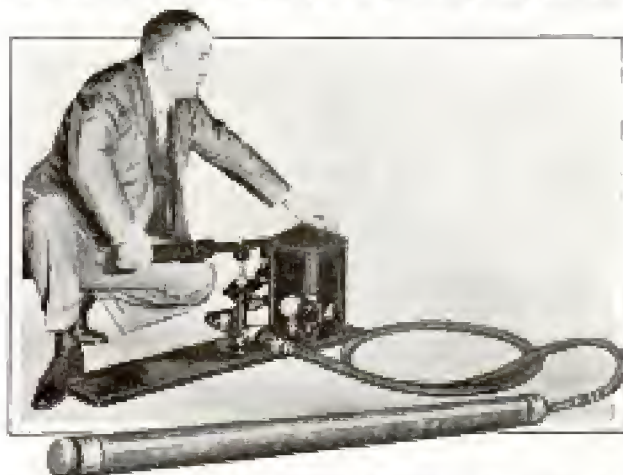
sued recently by the American Medical Association against the use of the metal as a rat poison. Numerous deaths have followed use of the substance as a depilatory and in the treatment of ringworm of the scalp, and several fatal cases of thallium poisoning have been reported from the use of thallium-treated grain for the destruction of ground squirrels. It is also poisonous to plant life. Other symptoms are neuritis and visual disturbances.

B. 696

WATER BOMB IS SAFER THAN EXPLOSIVES IN MINING COAL

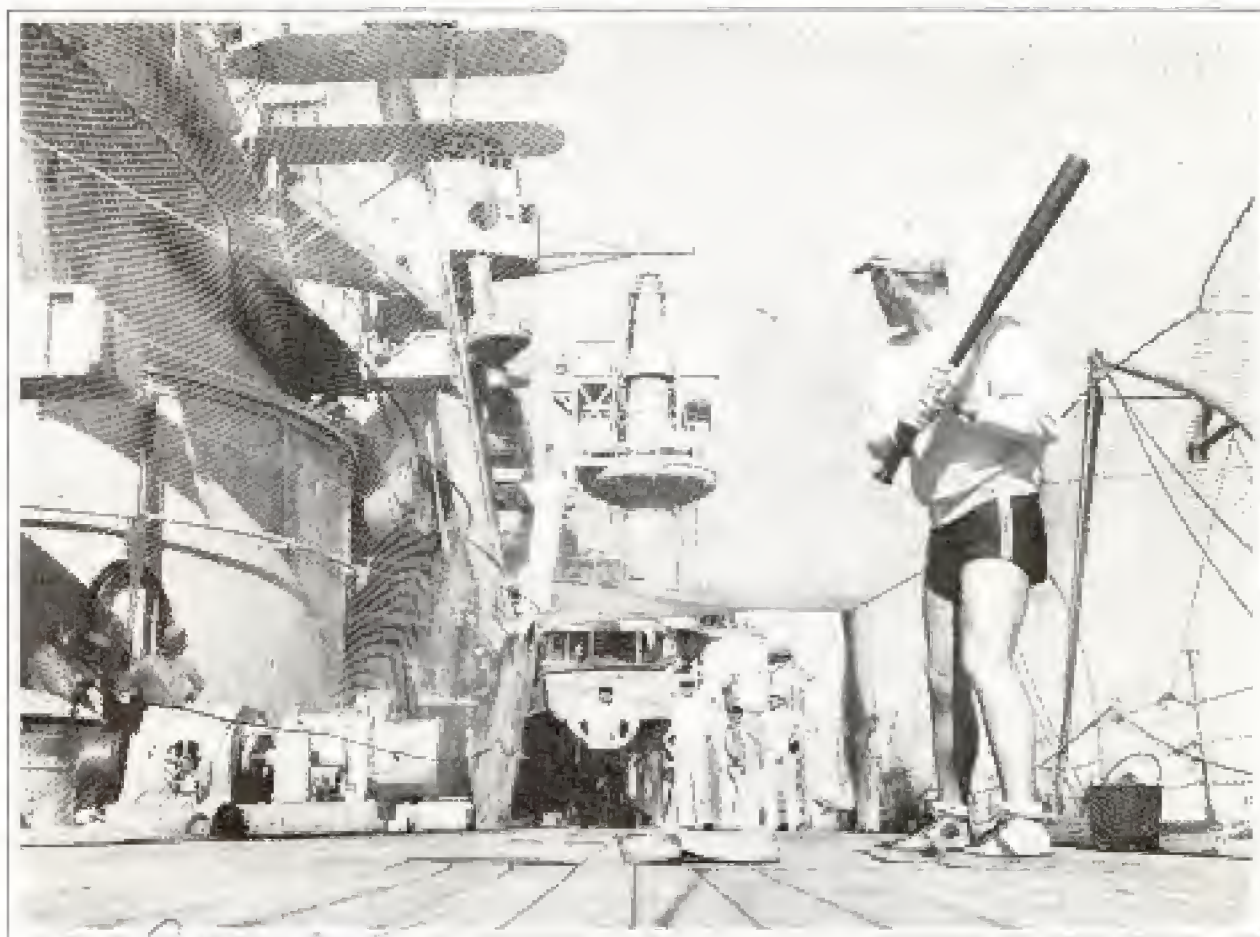
Dangers of mining coal can be reduced by use of a hydraulic bomb, or coal breaker, that has been tested successfully in lignite, bituminous and anthracite workings. The bomb, constructed of rubber, is inserted into a hole drilled in the coal and internal pressure is applied by a hand-operated hydraulic pump that can exert a force of more than 2,500 pounds to the square inch, while coal is broken down at from 350 to 1,500 pounds. The time required to raise the pressure to the breaking point is less than two minutes.

The hose from the pump to the bomb withstands pressures up to 7,000 pounds. Only nine quarts of water is needed to give the highest pressure. The bomb is used many times, since it does not burst.



Hand-Operated Pump Forces Water through Bomb, against Coal in Safer Mining

Meyer Rotary Engine Co
511-17
Denver, Colo



Net Inclosures Help Sailors Get Their Batting and Throwing Practice in Training for Baseball aboard United States Battleships; the Cage Keeps the Ball from Going Over-board

SEAGOING BASEBALL PRACTICE KEEPS SAILORS FIT

Baseball practice on ships far from shore is made possible by batting and throwing cages inclosed by netting. Spring training for the United States fleet began while the warships were on their way from Hawaii after the maneuvers in the Pacific. The ball may be hit hard, as the nets keep it from going overboard.

nocturnal activity of some animals tends to increase with an increase of relative humidity, and a decrease of air temperature and rate of evaporation.

STUDENT MAKES FAD HELP PAY FOR HIS EDUCATION



Capitalizing the inclination of college men to display the insignia of their alma mater, a student of the University of Kansas has gained a substantial income by painting miniature emblems on watch crystals.

When painted on the inside of the crystal in oil, the miniature is fully protected, yet does not interfere with the movement of the hands. Most popular subject is the "Jayhawk," a fantastic bird evolved as the mascot for the university.

WHAT ANIMALS DO AT NIGHT SHOWN BY FLASHLIGHT

Studying beetles under the bark of trees with the aid of a flashlight is part of the job of learning what animals do at night within the forest depths. Three scientists made these observations on the behavior of nocturnal animals. Creatures that move in the dark have an average range of activity from 8:23 p.m. to 4:41 a.m. The maximum activity usually occurs toward the middle of the night, between 10:00 p.m. and 2:00 a.m. It was found that

University of Illinois
Urbana, Ill.
Kent State College/Kent, Ohio

Only John Schuchert
Student
Hospital, Lawrence, Kans

Science Service
4/16/32

B 360 Cmt Charles W. Person.
452 Webster Ave
New Rochelle, NY

... Jack Shark —



A School of Sharks, Led by a Twelve-Foot Tiger Shark, Attacking a Sea Turtle

WHAT are the facts about sharks? Do they actually attack and kill? Are they more vicious at night than during the day? Are the small ones as dangerous as the large ones? Is it true that they nip off paddles and capsize canoes? Are they a menace to deep-sea divers? Questions such as these are asked daily by thousands who visit aquariums. The answers are seldom satisfactory because most information is based upon hearsay. One man who has devoted

his life to the study of fishes is now in possession of a mass of striking evidence based on both original research and verified experiences of other students of ma-

Left, the Spacious Jaws of a White Shark, Compared with a Man's Head



rine life. He is Charles Haskins Townsend, director of the aquarium of the New York Zoological Society. For four years, Mr. Townsend has been centering his special attention upon "Jack Shark," the sailor's name for the tiger of the deep. As a result, he has little patience

Sea Criminal at Large!



Above, Shark with His Satellites, Pilot Fish on Top and Shark Sucker Below

with those who seek to defend the animal. Sometimes he is asked by a doubter, "Did you ever see a man killed by a shark?" His quick retort is, "Did you ever see a man murdered?"

Sharks frequent the warm ocean currents. There are only a comparatively few instances of loss of life from these big fish in northern waters. In the warmer seas, however, they are abundant and constitute an ever-present menace. Some students of marine life had hoped that the recent extension of the shark-leather industry to many parts of the world and the placing of a worthwhile price on the head and hide of this old criminal of the sea would serve to reduce his numbers, but he is as plentiful as ever.

Even the growing popularity of shark fishing apparently has had no effect in

decimating his ranks. The Cuban government on Sept. 5, 1931, canceled the exclusive shark-fishing concession held by a Havana company and declared such sport open to the public. This action was taken in the hope of ridding the waters near Havana of man-eaters which, the government proclamation declared, "have killed three bathers in the last ten days."

Sharks soon appear in any warm water when a vessel stops. At first one will swing carelessly about the ship. Soon others appear, the size of the school depending on what is thrown down the galley chute. To attract a multitude, it is only necessary to hook one, hack it to pieces and distribute them in the waters below. Immediately the sea fairly boils as these ravenous fish concentrate on the remains of the kill. Let one of them be temporarily incapacitated in the rush and his fellows will turn upon him in a flash and tear him to pieces.

When excited by a few mouthfuls of food, sharks will seize almost anything. A fourteen-foot shark in captivity at Honolulu, after being fed a large piece of meat,

P3360



Below, Ground Shark About Ten Feet Long, Considered Dangerous in Both Caribbean and Mediterranean Waters

seized a wooden box a foot square and crushed it. The stomach of another shark taken at Honolulu contained a horse's leg with hoof and shoe, a gunnysack, a tin can six inches square, one squid, a peck of turtle shell and various small articles, some as indigestible as the proverbial diet of a goat.

In his deep-sea explorations among the islands of eastern Polynesia, Mr. Townsend caught many kinds of shark, large and small, and questioned natives, who regard sharks as dangerous under certain conditions and are accordingly circumspect in dealing with them. Further investigation has convinced him of the great abundance and ferocity of sharks and brought out the fact that danger is not confined to those of large size. Native stories, carefully checked, revealed the fact that a shark not so large as a man can easily mutilate and pull down a helpless swimmer although unable to carry him away.

The South Sea islander has the same regard for the shark's prowess that the African has for the lion and, like the latter, does not fear to hunt and kill him when conditions are favorable. The natives are as much at home in the water as on land, and occasionally a bold individual will plunge down after a lone shark and kill it with a knife. This exploit, however, is not attempted with all kinds of sharks, nor, indeed, by many natives. The native fears the shark less in the daytime than at night. The shark has the advantage in the dark and is much more aggressive.

In some parts of the South Pacific, sharks follow boats and canoes at night, nipping at the oars and paddles and not infrequently at the light outriggers. Large sharks in these waters frequently tear heavy oars from the hands of the rowers, and have capsized boats with fatal results

Here Is What Happens When a Tiger Meets a Tiger; This Hammerhead Shark Was Torn by Another Shark While Fast in a Net

to the occupants. Mr. Townsend describes the following tragedy of the Ellice islands which was related to him at widely separated points in Polynesia:

"About forty natives were crossing in canoes at night between islands several miles apart. A squall overtook them and one of the canoes was swamped. The occupants were immediately seized by sharks which had been following the fleet of boats and nipping the paddles. In a few moments great numbers of maddened fish were seizing paddles and outriggers until all the canoes except one had been swamped and their occupants devoured. Only two natives escaped to describe the disaster."

A similar account was obtained by Mr. Townsend in the Fiji islands. Here a large double-sailing canoe was capsized well off shore and over twenty natives who were clinging to the wreck were pulled under by sharks.

In a visit to the Low archipelago, Mr. Townsend found that the natives often swim and dive freely in the lagoons of certain atolls when they would not think of doing so in the deep entrances, where a single shark of great size keeps watch. Natives will sometimes swim about anchorages or even bathe near the deep entrances to lagoons in the daytime when they could not be persuaded to do so at night. Here sharks are so abundant about certain islands that a commercial fishery is maintained for shark fins, always a choice dish for the Chinese.

"Here and there among the islands," says Mr. Townsend, in his report to the New York Zoological society, "are reefs where the natives go for some of the larger food fishes. Such places are usually infested with sharks which cause great annoyance by following the canoes and seizing fishes that have been hooked. When a too persistent shark menaces the frail canoe it must be beaten off with paddles or fish spears.



Above, the Tiger of the Sea in His Element; Note the Shark Sucker Clinging Tenaciously to Him; Right, Samples of Shark Leather, Including Black, Brown and Tan. Smooth and Shrank



"The native fisher on the more distant banks off shore will gladly avail himself of the use of a good-sized dinghy or whale boat which has no outrigger to be seized by an ugly shark. However, it is not by any means the largest sharks that are the most dangerous. Many small but active species move in schools and at times actually swarm about a canoe, not merely interfering with fish catching but endangering the light craft.

"Sharks always have been regarded as distinctly dangerous in Australian waters, where there are several large species," says Mr. Townsend. "They were particularly so at Sydney, where for a time butch-



Above, Fishermen Laying Nets for Sharks; Below, a Fine Specimen of the Big Tiger Shark

er-shop waste was allowed to be thrown into the harbor. Swimmers about the docks were carried off by sharks on several occasions in the day. In the Solomon islands, the singular ferocity and boldness of the sharks are said to be due to the native custom of throwing dead bodies into the sea.

"Natives in the Hawaiian islands are cautious about venturing into deep water near steep cliffs and then seldom without a long-bladed knife. The native surfboard riders disport themselves in waters where sharks are not often seen, the shallowness of the water and the disturbance made by the riders serving to keep the sharks at a distance. However, accidents occur. The director of the aquarium at Honolulu has told me of several instances of killings and mutilations by sharks. His information checks with mine, in that sharks will at times attack not only men but canoes, and when hungry will grab at anything they see in the water."

Typical of Mr. Townsend's material which constitutes an iron-clad case against the shark are these authenticated accounts:

"Pepekeo, Hawaii. A Japanese fisherman holding a net fell overboard and persons on the cliff near by who could do nothing to help him saw him pulled under by a shark."

"Kalepolepo, Island of Maui. While diving to take fish from a net, a fisherman was seized by a shark which stripped the flesh from his arm. His arm was amputated at the shoulder."

"Mana, Island of Kauai. A Japanese fisherman swam out to gather fish floating on the surface which had been killed by dynamite. When warned of the presence of a shark, he swam frantically for the rocks but was seized and pulled under. As he disappeared it was seen that he had his arms around the shark's body."

"T. C. Roughley, Technological Museum, Sydney. It was thought for many years that bathers were safe so long as they kept in the broken water, but during the last couple of years bathers have on two occasions been attacked right in the surf. After the initial attack the shark usually returns quickly and continues the attack until it is frightened away by other bathers."

Mr. Townsend's data constitute an indictment against such hardened sea crim-



Top, Mouth of Tiger Shark, Containing Seven Rows of Teeth, 250 to 300 in All

inals as the tiger shark, whaler, hammer-head, gray nurse, blue pointer and white shark. As to other species, those humans who have been mutilated are rarely able to remember just what kind of a shark attacked them. The word to the wise is, sharks kill.

But—and the reservation is significant—sharks do not attack deep-sea divers. It is too bad that more movie directors don't know this. While cruising with the pearl divers off La Paz, Mr. Townsend put on a heavy diving suit and went down on a coral bank where he thought he could get very close to his enemy—close enough,

say, to see the white of his eye. But the enemy didn't appear. Later he discovered that the divers do not fear sharks, for the upward-leaping air bubbles from their helmets keep sharks away. However, these divers have a very wholesome respect for that species of fish known as the manta rays, who are always full of curiosity and whose broad wings have been known to hit the divers' air and life lines, almost jerking them off their feet.

Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

B 503 C.W. Joseph H. Mountain
650 Diamond St. N. E.

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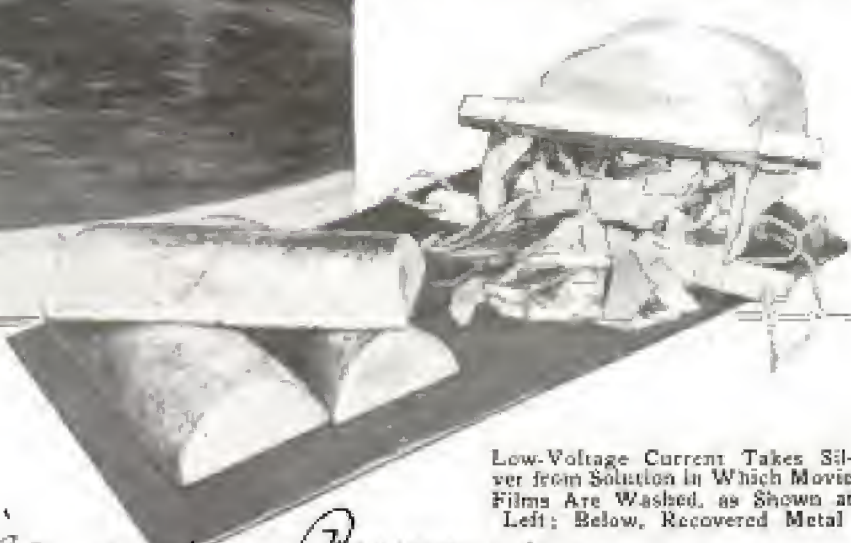
POPULAR MECHANICS

Los Angeles Calif.

Science Finds Silver Mines in Movie Studios



one large movie studio, about half a million feet, or nearly 100 miles, of film, including negative, positive, and sound track, is developed every day. From this enormous quantity, the hypo solution dissolves about sixty-five pounds of silver—about as much as there is in 800 silver dollars. Many tons of ore from an ordinary silver mine would have to be smelted to get so much of the metal. The new process of recovering this silver from the used fixing bath is very similar to electroplating of tableware. A low-voltage electric current, passed through the solution in special plating cells from a car-



Low-Voltage Current Takes Silver from Solution in Which Movie Films Are Washed, as Shown at Left; Below, Recovered Metal

A valuable silver "mine" discovered in the heart of Hollywood, the motion-picture capital of the world, has produced more than \$21,000 worth of silver bullion in its first six months. This mine, which is a remarkable new electrolytic plant for the recovery of waste silver from film-fixing baths, is so successful in its operation that already another installation is under construction and several more are planned. Unlike the mines of desert and mountain discovered by the prospector or engineer, this silver producer is the result of years of tireless investigation by Dr. K. Hickman and his associates in the research laboratories of the Eastman Kodak company. Hypo solution, the fluid used to fix the image on photographic film, dissolves the unexposed silver from the developed film. Soon the solution becomes so loaded with silver that its value cannot be ignored. In

Electrolytic Regeneration of Fixing Baths
bath plate to one of stainless steel, carries with it a small amount of silver which it deposits on the steel plate as a thin metallic film. Unlike the plating of silver tableware, the deposit on the steel plate must strip off easily. After the silver is built up on the plates to a thickness of one-sixteenth to one-eighth of an inch, it is stripped off and melted into ingots which are of such high purity—ninety-eight to ninety-nine per cent—that they may be sold directly to the mint or other large silver users. The recovery of the silver is not the only saving effected. After the hypo is filtered and its silver removed, it can be used over again. The same bath may be used about three times.

full account in Journal of Society of Motion Picture Engineers. Report from Eastman Kodak Co. Rochester, N. Y.

used at Metro. Studios, Culver City, Calif.

Rochester, N.Y.

E. L. Summer
California
of Fuel and Isame.
 POPULAR MECHANICS

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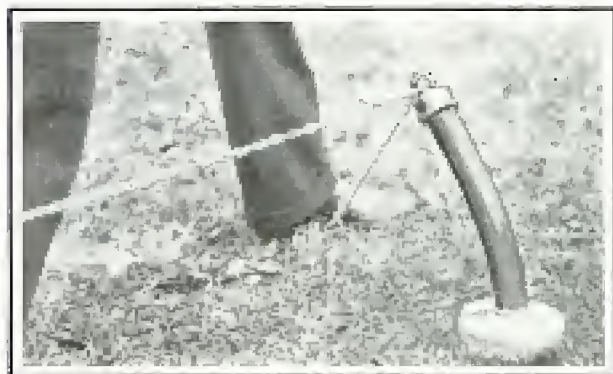
See new New Letter 4/16/32

ALARM CLOCKS TO SAVE GOLDFISH FROM HERONS

Alarm clocks are making the world a safe place for goldfish in a pool in the public square of Alameda, Calif. It was found that black-crowned night herons were preying on these fish. It was impracticable to put a guard to keep the herons away and finally four alarm clocks were attached to trees near the pool where the birds roosted. The alarms were set to ring at half-hour intervals. After a week of sleepless days, the herons gave up and the goldfish have not been bothered since.

RUBBER FENCEPOST HELPS PREVENT ACCIDENTS

Made of rubber-covered coil springs, a flexible post for lawn or curbstone fences has been designed. The posts bend when someone stumbles over the chain that connects them, averting bad falls. When automobiles back against the curbing guards, the posts spring back into position when pressure is removed. This represents a saving on broken posts. Holes in the top allow a chain or rope to be run through in setting up the fence.



When You Stumble on the Lawn Fence Chain, This Post Bends, Preventing a Bad Fall



Resembling Bombs. These Individual Microphones Carry Each Speech to Recorder; Note Control Box in Foreground

SPEECH RECORDER LISTENS IN ON BIG CONFERENCES

Every word spoken at lengthy business conferences, or similar round-table meetings, can be taken down electrically by a new speech recorder. Individual microphones, with signal lamps on top, are placed in front of each member of the group at the conference table. The chairman, as he calls on a certain conferee, switches on that person's microphone. The mike picks up his speech and carries it to a machine that records it on a steel wire two miles long. The wire can be played back, serving as a permanent record. The device operates from any electric socket.

Telegraph wires in East Africa are mounted on exceptionally high poles to protect them from giraffes.

Photo holder apparatus.
Myo, Miro + Lumbert, Berlin. Tempelhof.
Constr. S. Berlin

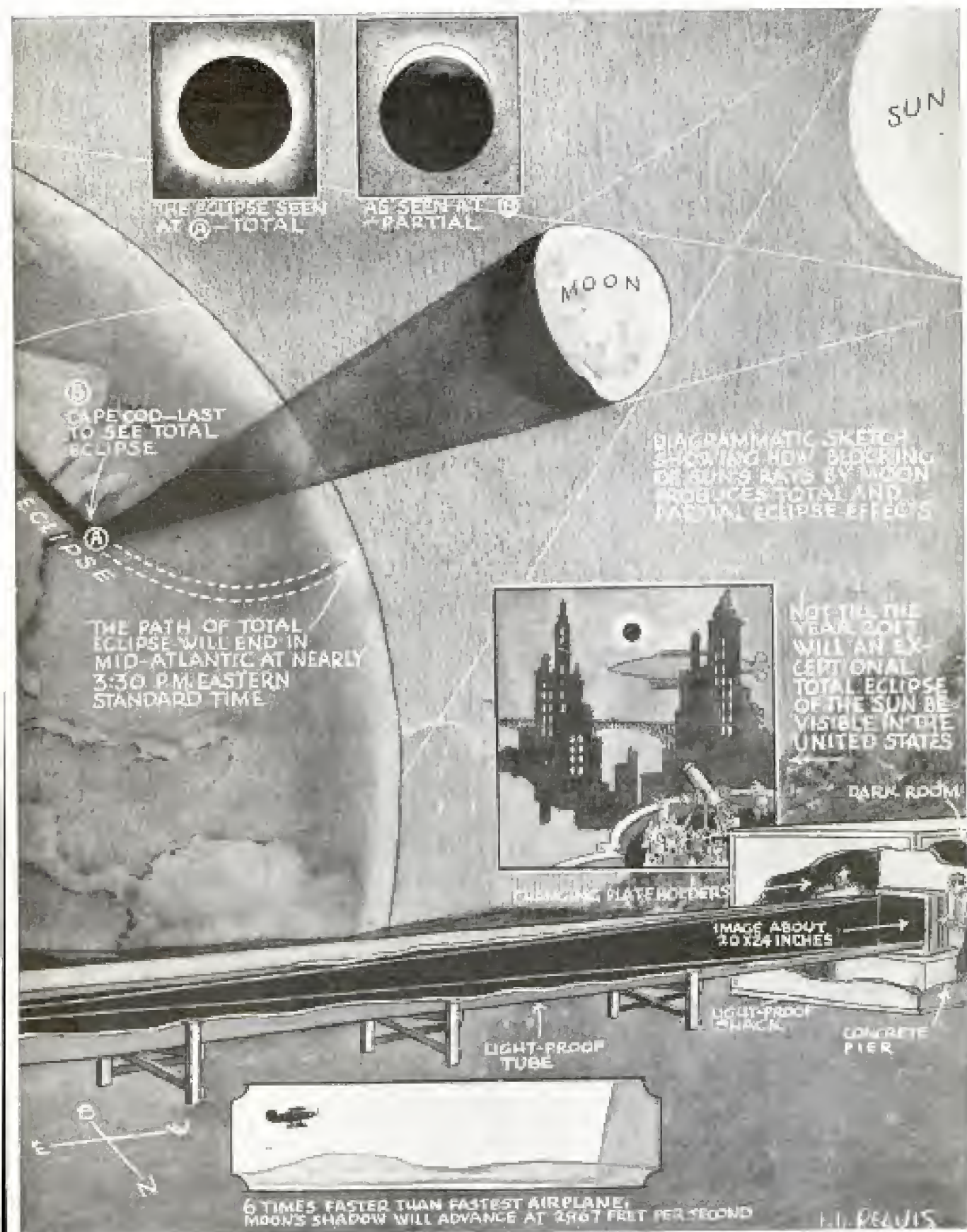
Adolph F. Blum
The Flexible Fence
Post Co., 623 Leavenworth Place
Chicago

Coming Solar Eclipse to Be the Last Visible to



Diagrams Showing Path of Total Eclipse of Sun, August 31, and Some of Effects Astronomers Will Have an Opportunity to Study for Last Time in This Country Until Year 2017

Most of the U. S. in About a Hundred Years



At Bottom, Drawing of Giant Camera Which Will Make Large Pictures of Eclipse; Reflecting Mirrors Moving in Time with Eclipse Throw Image into Tube Over Eighty Feet Long

George R. Meyer, 120 S. La Salle Chicago



Revolving Cogs on This Machine Do Sixty Men's Work in Picking Cotton

COTTON PICKER GATHERS CROP AS FAST AS SIXTY MEN

After spending half a million dollars and most of his spare time for six years, a wealthy Chicago manufacturer has made a mechanical cotton harvester that will gather the crop as fast as sixty men could do the work. The machine passes over the plants and uses revolving cogs, which pick the cotton bolls as it passes over the stalks.

TROLLING WITH AN OUTBOARD EASY WITH ATTACHMENT



Slow trolling in an outboard motor-boat is made possible by an automatic guard that is attached to the propeller. When the motor is pushing the boat at lowest speed, wings on the device spread, retarding the movement to a drift suitable for trolling. If

W. H. Wendt & Son Mfg. Co., Little Falls Minn

the motor throttle is advanced, the wings fold to give the propeller more pulling power. The device is made for all leading motors and can be attached without removing the propeller.

THE SECRET OF LIVING LIGHT

Organisms that shine in the dark, like fireflies and the germs that cause the light of decaying wood, or fox fire, have developed this ability from one of the chemical reactions that underlie ordinary breathing, according to Prof. E. Newton Harvey, of Princeton University, who has worked on the problems of living light for many years. Continuous glow, exhibited by bacteria, and intermittent glow, exhibited by practically all other organisms, are the two principal forms of such light. The intermittent type is well ex-

hibited by the common firefly. Intermittent luminescence ordinarily takes place only in response to a stimulus.

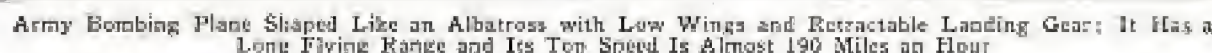
"HOOD SPATS" DRESS UP AUTO COVERING LOUVRES

Helping to bring the old automobile up to date, door-type vents for the hood are being offered. The vents, designed like those on the latest models, can be attached to the sides of the hood with a screwdriver. Chromeplating on the vents adds much to the appearance of the old auto and is rust-resistant.



Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and will be furnished free upon application to our Bureau of Information.

*The Kneipfel Co
Suttenberg
Copyrighted material*



Built somewhat in the shape of an albatross, a new bomber plane with low wings and retractable landing gear has been adopted by the army. Its top speed is said to be about 189 miles an hour, much faster than previous craft of this type. Another of its features is long flying

range. It is powered by two Hornet engines of 575 horsepower each and carries a crew of four, a gunner-bomber in the nose, a pilot aft of him and, in a cockpit placed considerably to the rear, a gunner-pilot and a radio operator. The ship can be operated from either cockpit. The engines are mounted in wing nacelles, making an exceedingly trim-appearing craft, with landing gear retracted in flight.

Originally developed for difficult drilling on the framework of the large dirigible "Akron," an angle bit for drilling around corners, or in places not easily accessible, has been found applicable to almost every field of mechanical activity involving the making of holes. The bit can be used in any chuck that will hold straight-shank drills, requires no altering of the chuck or driving mechanism, and is particularly adapted for use with electric drills. It consists of a steel casing with the end set at the desired angle inside of which is a system of shafts and links to transmit the power around the corner of the angle without appreciable loss. The link system is kept in place by end bearings and the drill is held either by a set-screw or small chuck. The casing of the bit is held in the hand to prevent rotation. The device is unusually compact, the size

designed for use with one-quarter-inch bits being only one-half inch in diameter. The airship worker who invented the bit has also made a vibration damper for use between it and the drill chuck that drives it. This is an improved type of universal joint enabling use of bent drills or angle drills with shaft out of line.



J. H. King 328 & 260 H. St.
Cleveland, Ohio.
prices from \$5.50 upward

New CONVENIENCES



Left, Grinder That Kinkles or Crushes Whole Grains for Breakfast Food; Right, Faucet Turned by Push of Wrist



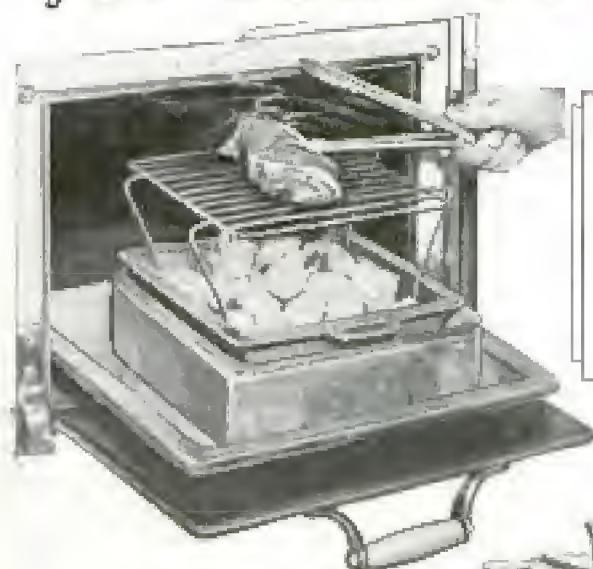
Right, Bottle with Pouring Ring, to Prevent Spilling; Right, Below, Safety Shelf and Runner for Kitchen Stove; the Trays Remain Level When Drawn Out Loaded, Preventing Spills and Painful Burns



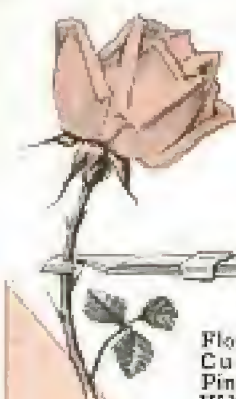
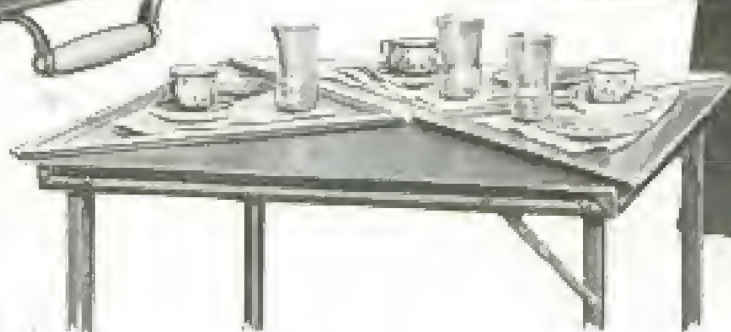
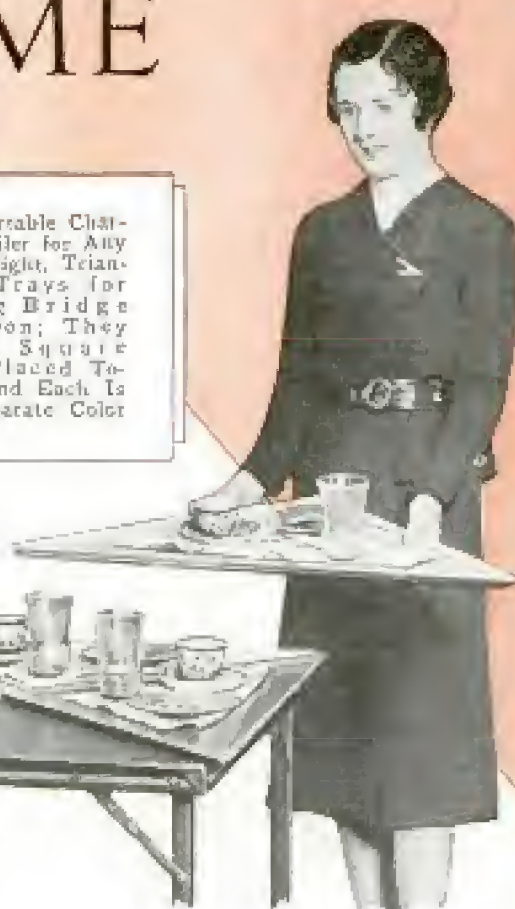
Oil-Burning Range That Consumes Fuel Oil and Generates Gas without Wicks, Weights, Springs, Pressure Pumps or Other Intricate Mechanisms; the Range Will Boil Water as Quickly as a Gas Stove of Similar Construction



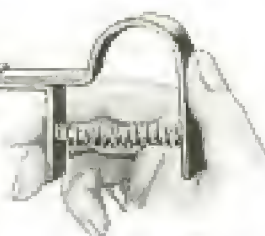
for Your HOME



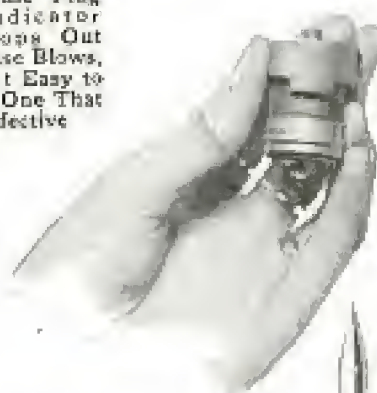
Left, Portable Charcoal Broiler for Any Oven; Right, Triangular Trays for Serving Bridge Luncheon; They Form a Square When Placed Together and Each Is in a Separate Color



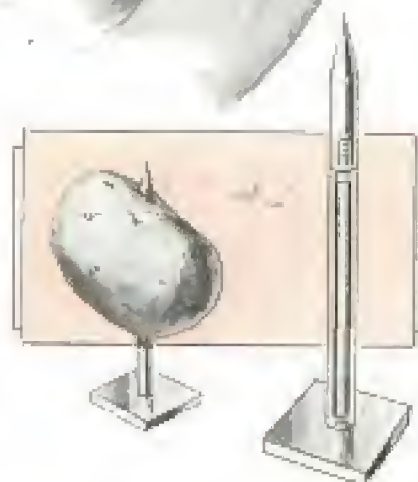
Flower and Shrub Cutter Which Pinches the Stem While Cutting, Thus Causing the Clipped Buds to Last Longer



Right, Fuse Plug with Indicator That Pops Out When Fuse Blows, Making It Easy to Find the One That Is Defective



Below, Flat-Plate Ironer for Home That Fits in a Table Like a Type-writer Desk



Above, Metal Skewers for Roasting Meats and Baking Potatoes; Part of the Heat Is Carried Inside the Food by the Metal Prong

B695

Rolling Boat to Skim the Water on Floats

Water resistance has been minimized in a "barrel" boat invented by a Frenchman and powered by a nine-horsepower motor which drives an air propeller. The craft is set on a frame sup-

This Speedy Craft, Supported by Barrel Floats, Rolls over the Water, Driven by Air Propeller; the Arrangement Makes It Difficult for the Boat to Capsize

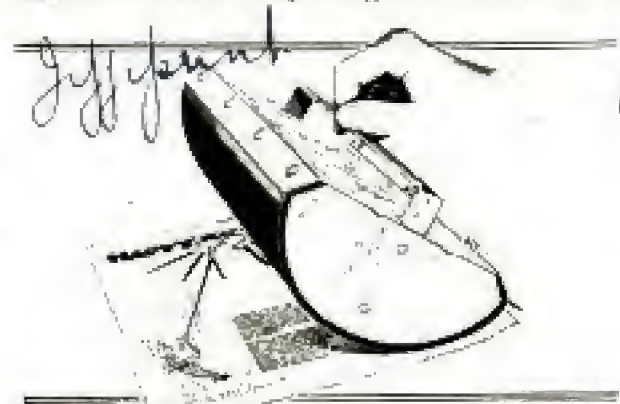


ported by three barrel-shaped floats, and the air propeller tends to decrease the draft until the boat skims over the surface. It is virtually impossible to capsize the craft which has a speed of more than eighty-five miles an hour, according to the inventor.

PRINTING CARDS MADE EASY WITH HAND DUPLICATOR

Typewritten letters, tracings or written matter—in fact, anything that can be im-

printed on a stencil—are copied quickly by means of a hand-operated duplicator that is compact and easy to operate. It consists of a metal frame with a curved inking pad to which the stencil is attached and is operated by rocking the duplicator over the paper. Copies can be made as fast as the sheets can be laid down. There are two sizes, the larger printing a full-size letter or handbill, while the smaller is suitable for postcards and like matter.



Hand-Operated Duplicator That Works Like a Rubber Stamp Copies Any Printed or Written Matter

ROPE IS MADE WEATHERPROOF BY RUBBER TREATMENT

Cotton cords and ropes impregnated with rubber by a British process are said to be waterproof and to withstand exposure to all kinds of weather without deterioration. It is also claimed the rope so treated is not affected by sea water, fumes or tropical heat, and neither shrinks nor becomes longer whether wet or dry. The cord has been found ideal for use between pulleys and also is being used on boats and as a support for radio aerials.

Mrs. Basil H. Purdy, St. James St. Rose and Crown Yard, Derby, England

M. Echerleu. Paris

B-730
A-4 1/2 x 3 (9.75)
B-117.75) 7 1/2 x 9 1/2

See Johnson Co. 1801
Byron St. Chicago

Harbour Cove Bldg
608
Cable Montague, 608
Cable in Am. Cons.
Toronto

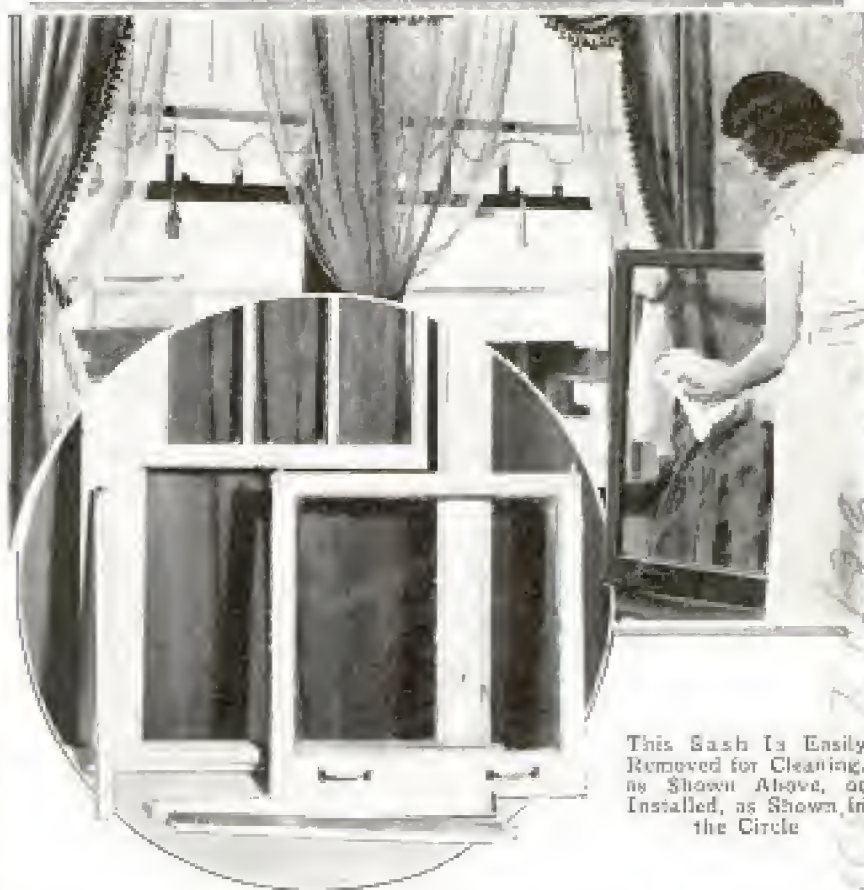
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1 deer iserbach
1 rail 841
B-8*

B-656

Chicago Blade Nov 4/123/32

WINGED BULLET CUTS ARMOR AT THIRTY YARDS

Among the latest death-dealing inventions for use in time of war is a "winged" bullet that can pierce armor plate half an inch thick at a thirty-yard range. The bullet has two circular wings or fins of soft metal running around it. These fins are compressed as the bullet forces its passage down the narrowing barrel of the rifle. The effect is that pressure is maintained at full intensity until the bullet reaches the muzzle, producing the extraordinarily high bullet velocity of 5,000 feet per second. A projectile that can pierce one-foot-thick armor of any modern warship at nine miles' distance also has been produced. Armament experts believe that this shell will check the modern tendency to sacrifice protection for high speed, resulting in a change to thicker armor plate and slower speed for battleships.



This Sash Is Easily Removed for Cleaning, as Shown Above, or Installed, as Shown in the Circle

REMOVABLE-SASH WINDOWS SLIDE ON SPRINGS

Eliminating the danger connected with cleaning, painting and glazing windows from the outside, a double-hung window that can be removed from the frame is now available. Both sashes may be removed and replaced in a few seconds. There are no ropes, weights, pulleys or weight boxes, the sashes being controlled by springs. The window is metal-stripped at top, sides and bottom to make it weatherproof. Narrower frames can be used, since weight boxes are unnecessary, giving the windows a neat appearance. Brick construction may be continued right up to the solid plank frames.

PENKNIVES SHAPED LIKE COINS ALSO CONTAIN NAIL FILES

Pocketknives shaped like coins are being offered as convenient to carry in change pockets or purses. These little



Coin-Shaped Pocketknife, About Size of Quarter. Contains One Blade and a Nail File

knives are about the size and shape of a quarter when closed and contain one small blade and a nail file.

BEETLE GROWS ITS OWN FOOD

Beetles that raise their own food in tiny fungus gardens have been found in the eastern United States. While this insect is a wood borer, it does not feed on wood, but grows different kinds of fungi, or ambrosia, in galleries within its home. Each species of the beetle raises and exists on a different fungus.

Segal Lock Hardware Co. 12 Warren

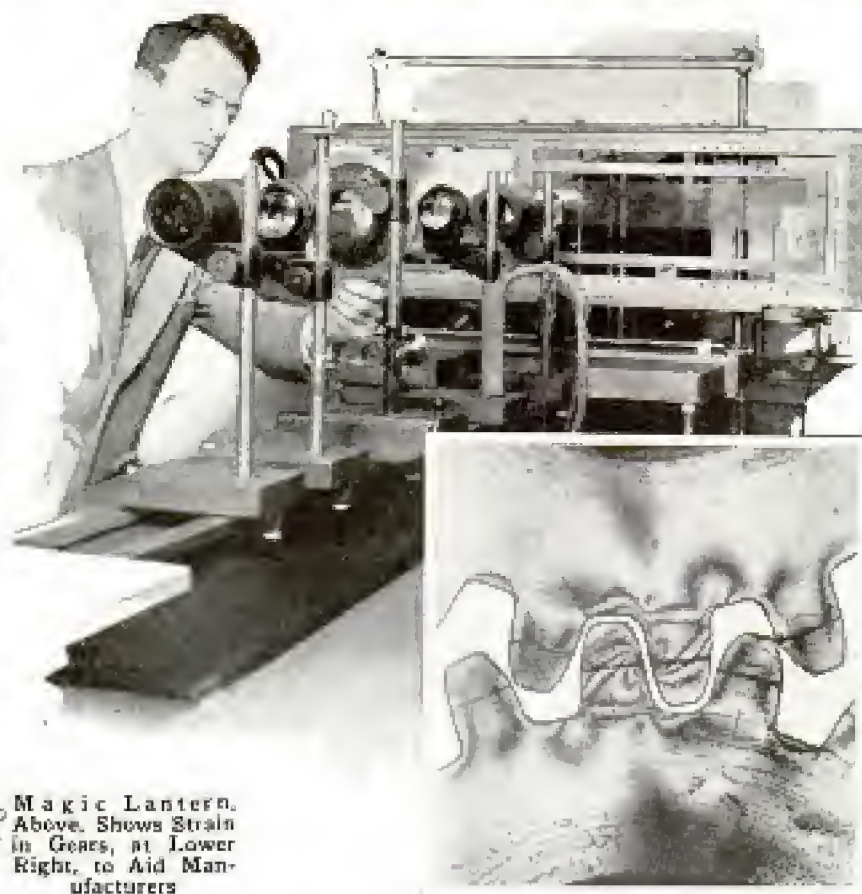
Mr. E. Porter Fell. New York

B-861

*Paulsen Mfg. Co. 6789
27 Q24 Normal Gro Chicago
(W. A. Trumbull)*

B 7 50

Chas. Sterling Isleson
2207 Isleson Ave
Venice, Calif



Magic Lantern.
Above, Shows Strain
in Gears, at Lower
Right, to Aid Man-
ufacturers

STRAINS AND STRESSES SHOWN WITH MAGIC LANTERN

Strains and stresses of machinery in operation have been photographed and pictured on the screen by a magic lantern developed in the laboratories of the Westinghouse Electric and Manufacturing company. Models of gear teeth, crane hooks, railroad rails and other shapes, made of transparent material, reveal the effect of typical loads when a beam of light passes through the models. Resulting shadows and bright colors show the location and direction of the strains. By studying views of the model machines, engineers are able to construct parts so that the greatest strength may be placed where needed.

LAUNDRY FOR OIL-WELL MUD CUTS DRILLING COSTS

When mud used in drilling oil wells becomes mixed with sand, drill cuttings and gas bubbles, it is unfit for further operations. A huge washing machine that scrubs, screens and weighs the mud has been devised to reduce drilling expenses. After the mud has been put through the "laundry" it is as fresh and clean as new,

ready for the drills. Pumped in from surrounding wells, the mud is passed through screens that remove all foreign substances. Then the gas bubbles are allowed to escape, and the mud is passed to automatic scales that dump their load of fifteen pounds. When the mud can be passed through a standard 300-mesh screen, it is pumped back to the drilling well or into storage tanks. The washer operates at a small portion of the cost of new mud.

TRAIN BATTERIES ARE CHARGED BY TROLLEY

Loading a battery-driven train with electric "fuel" is a speedy operation on an Irish railroad where overhead wires have been installed to perform the operation without removing the cells. At various points along the road, the cars are run under these chargers and receive their new energy in a very short time, just as a steam locomotive is loaded with coal or oil and water. The batteries and the charger are the invention of a Dublin professor who has succeeded in effecting a combination that does away with the long waits associated with battery-driven vehicles.



Photo, Independent Newspapers Ltd
Batteries in Electric Train Get New Energy by Contact with Overhead Charger

Carl Patterson, Po.

B 8 46

Used by Union Oil Co
at Dominguez Calif
field

Dr. L. L. Brown, Prof
Physics, National Univ
Irish Free State

Com. Wallin
Dublin Ireland

33732 International Harvester Co
Chicago, Ill.
600 Michigan Ave
POPULAR MECHANICS *Chicago* 99



Replacing the Camel, This Tractor-Drawn Tank Hauls Water between Cities in the North African Desert

TANK REPLACES DESERT CAMEL FOR HAULING WATER

Replacing the water-carrying camels of early days, eighteen-ton water tanks are now hauled through the north African desert by motor tractors. The water must be taken into some Algerian cities.

POWERFUL POISON FROM WEEDS TO AID FRUIT GROWERS

Neo-nicotine, a potent poison used as a fruit-tree spray, has been found in a weed, native in Russia, after being produced synthetically in this country. Fruit growers have long been clamoring for something similar to the nicotine of tobacco for spraying purposes, because the latter is so expensive. As a result the department of agriculture formulated neo-nicotine out of a laboratory by-product, and has been working on a method of producing it cheaply and in quantity. Recently two Russian chemists turned their attention to a weed considered as a pest by the peasants, and found it contained a poisonous alkaloid which they named anahesine. Its chemical structure was described in a Russian journal, and department of agriculture chemists learned to their astonishment that the material obtained from the

weed was the same as that being made in a Washington laboratory. Samples of the Russian product have been analyzed and reveal that, except in one minute particular, the two newly found substances are identical. This reverses the usual process, for ordinarily a new substance is first found in nature, then the chemists, after much hard work, are sometimes able to make it synthetically.

CIGARET AND MATCH HOLDER MADE OF CARDBOARD



cardboard, the four-sided compartment holding any paper-cased package of cigarettes and a cardboard clip on the outside gripping a package of paper matches. The holder is collapsible.

Cigaretts and matches can be carried in one pack, offered as a handy case for the user and an advertising medium for the distributor. The pack is made of

Washington Star 4/26/30
03-882
03-805
Handbook
Adm. Gertrude
Deer Mac Day
same address
C. R. Smith
Director
Bureau of Chemistry and Soil
Washington D.C.
Copyrighted material
Brooklyn NY

3546 Cml. Harold L. Wilkins
Esq. Colchester, 29 Beaufort Road
Bexley Heath, N. London Eng

On the Trail of the



Ultraviolet-Ray Lamp Used at Royal Academy in London to Determine Authenticity of Paintings

By JACOB DESCHIN

WITH art collectors willing to pay a half million dollars for a single painting by an old master; a quarter million for a sixteenth-century Venetian helmet; \$50,000 or more for a Gutenberg Bible or a Shakespeare first folio, and \$16,500 for a couple of postage stamps, traffic in art fakes has grown to amazing proportions.

Some time ago a Paris newspaper estimated that nearly 15,000 spurious masterpieces had been sent to the United States and sold to unsuspecting collectors within a single year, and that the faking of Sevres chinaware, considered the royalty of pottery antiques, was by itself netting counterfeiters almost \$10,000,000 a year!

An examiner of antiques in the United States appraiser's stores at Philadelphia recently declared that at least fifty per cent of the antiques which came to his attention were fakes.

Ingenious as are the art fakers, however, modern science unmasks their handiwork—if the imposition is suspected. By

means of photography, the ultraviolet ray, the X-ray and various other scientific examinations, many a so-called masterpiece has been detected as fraudulent and turned back from museums and private collections.

But even science's exposing scrutiny is hampered by the inherent unwillingness of collectors to risk having their judgment proved faulty. When a collector has been duped, he prefers to



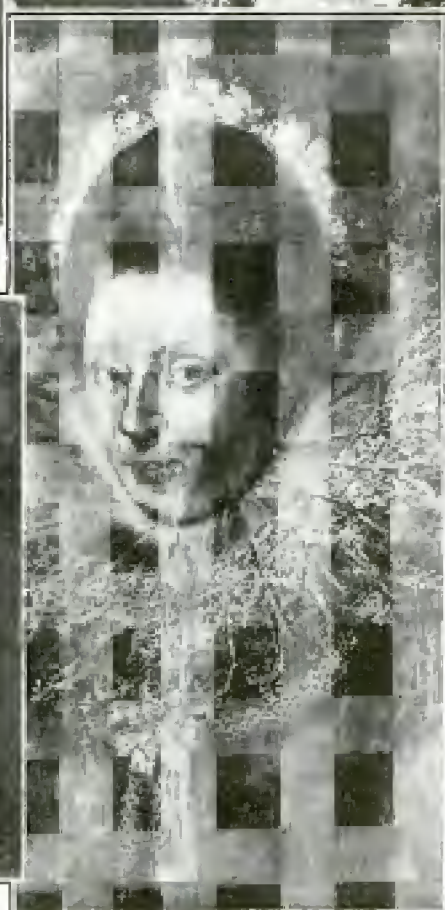
Photograph of Rembrandt's Painting of His Mother, and Enlargement of Hand to Show Brushwork

Art Faker

keep the fact a secret, fearing that he may lose standing as an art connoisseur if the deception becomes known. Then, too, there are those who purchase smuggled masterpieces and because of fear of being apprehended as accessory to a "shady deal," never put their treasures to the acid test.

Baron Rothschild, one of the greatest collectors of all time, was several times the victim of frauds. He once paid \$50,000 for an antique enamel work which he later found to be a faked article.

The former Kaiser Wilhelm personally backed up Dr. Wilhelm Bode, then curator of the Emperor Frederick Museum in Berlin, in the contention that a wax bust for



which he had paid \$40,000 was really the work of Leonardo da Vinci. Later, it was proved that the bust was of distinctly modern vintage. Evidence, in the form of bits of newspaper found in the composition of the bust, demonstrated beyond doubt that the bust was a modern copy.

The maker of frauds has been especially prolific in the field of painting. Since one sign of a painting's genuineness is the formation of cracks in the paint, the forger tries

Courtesy Metropolitan Museum of Art

At Top, Portrait of Queen Elizabeth by Frans Pourbus; Below, the Same Painting Before X-Ray Picture Showed It Had Been "Dressed Up"

Ancient Gilded Dolls Restored to Original Colors with Cellulose-Acetate Solution



to imitate this condition as best he can. Upon the completion of the painting, which he has produced through careful aping of the original artist's style and method, he proceeds, using a method which produces something similar to genuine crack formation. He may coat the new paint with a lacquer, which, when heated, pulls the underlying paint apart. In this process, however, the gesso, a coating on the canvas, remains flat and smooth, so one need only uncover some spot in the painting by rubbing away the color to recognize in the superficial crack formation the work of the forger.

To make the finished work look old, the faker brushes the painting with limewater and leaves it for a month in a damp cellar, thus obtaining a manufactured mildew. A bit of soot provides the dust of centuries—even flyspecks may be imitated.

No purchaser of paintings, no matter how inexperienced, need be victimized—if he is willing to submit his contemplated purchase to the searching scrutiny of modern science. There are too many tel-

lale traces which no amount of trickery can disguise.

If the signature has been forged on a painting of genuine antiquity, a microscope soon reveals the fact; if old cracks in the painting have been filled up by the new paint of the signature, the autograph is obviously false. If, when chemically analyzed, the paint of an "old master" proves to be of a type unknown in that period, the fraud is exposed.

Each painter has a characteristic brush work, as legible and distinctive to the art expert as a signature is to the ordinary man reading a letter. By making a microphotograph of a section of a doubtful painting and comparing it with a microphotograph of an authentic work of the same painter, the brush marks tell a story as plainly as finger-



Courtesy Dr. Alexander Seitz
Center, Fake Mexican Vase with Sand and Glue Base;
Below, Only Part of Relic That Was Genuine



© Planet News

"Doctoring" an Old Roman Tessellated Pavement Found near St. Albans, England, under the Roots of an Ancient Oak, Which, Itself, Is More Than 1,000 Years Old

prints. Because of their high value, perhaps the most numerous "victims" of the forger's art, are statues in marble and other stone. In order to approximate as nearly as possible the work of the sculptor, the faker confers the "abuse of age" by skillfully chipping the completed marble here and there with a mallet and chisel, and by applying sand and acid to dull the tooling, sometimes to cause corrosion, etc. One of the methods of aging is to wash the object with water containing a certain quantity of green vitriol. This solution penetrates deeply, particularly in marble, and the coloring is not easily destroyed or washed out by long exposure to atmospheric action. Rubbing the completed work with flannel is the finishing touch, which gives the shiny effect so often seen in old marble.

Under the ultraviolet light, however, the fake is easily detected. Old marble appears purple and new or treated marble white.

In the field of ivory, the forger has been

no less skillful and painstaking. He has imitated even the aging of the surface by first producing cracks in the work. This is often done by dipping the carving in boiling water and then holding it near a hot fire, thus producing rapid expansion and cracking. The mellow hue of old ivory is reproduced by rubbing the surface of the imitation with tobacco juice or bitumen, or by burning. Ultraviolet rays, however, detect the new ivory.

A terra-cotta bust which was once bought from a Venetian antiquary at a very high figure, and about whose genuineness there was not even a suspicion, afterward was discovered to have been made from a cast taken from the face of a recumbent figure on a tomb in a church, to which had been added the back part of another bust, and the whole finally set upon a pair of shoulders cast from still another figure.

A well-known collector recently presented the British Museum with what was purported to be an ancient Mexican fu-



© The London Times
X-Raying Old Box to Determine Contents Before Opening

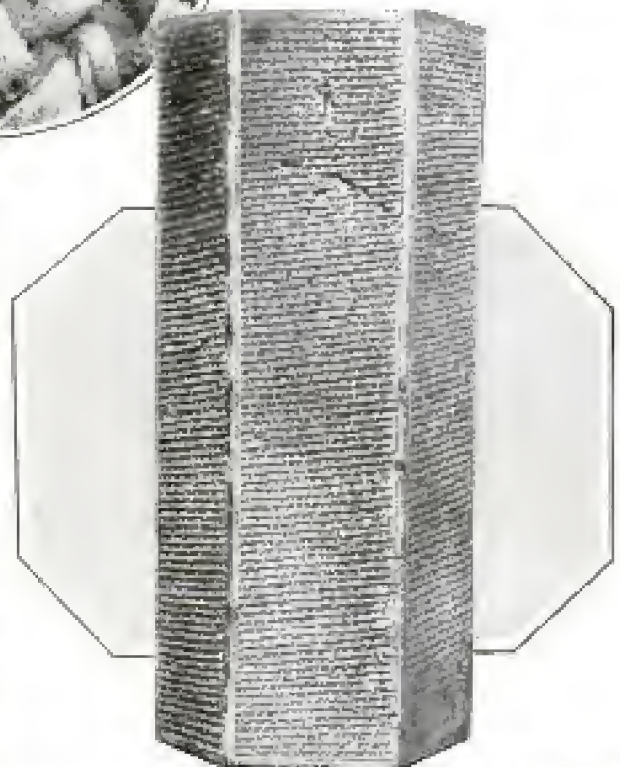
nerary vase, found in an Aztec grave. After a time, the lower part of the vase, apparently stone, began to flake off. Under the microscope, it was revealed that a very clever faker, operating with sand and glue, had built a remarkable imitation around a shapeless fragment of the original. He had "taken in" the donor, who was famous for his knowledge of these objects and had given the museum other unquestionably genuine Mexican antiques. The faker had artfully coated the shapeless original with a gray, cement-like mixture of sand and glue, which looked remarkably like fine-grained sandstone. But he had not taken into consideration the effects of the climate of London, which caused the coating to crack and peel off and so reveal the fraud.

With prints, drawings and books, the expert forger also has evolved a bag of tricks. To increase the value of a rare book, he will restore a missing page, without which the book loses immensely in value. To quadruple the worth of another book he will erase certain undistinguished

signatures and substitute in their places signatures which are more highly prized. To make a certain drawing worthy of a collector's notice, he will obligingly add a signature where no signature existed before.

Drawings and prints are executed on old paper, and further aged by soaking in dirty water. Drying and scouring with pumice complete the appearance of age.

Equally interesting as their fraud exposures are the restorations executed by great museums, many of them requiring extreme ingenuity. And, as might be expected when dealing with objects of almost priceless worth, this restoration must be carried on with extreme delicacy. A short time ago, a leather scroll, about two thousand years

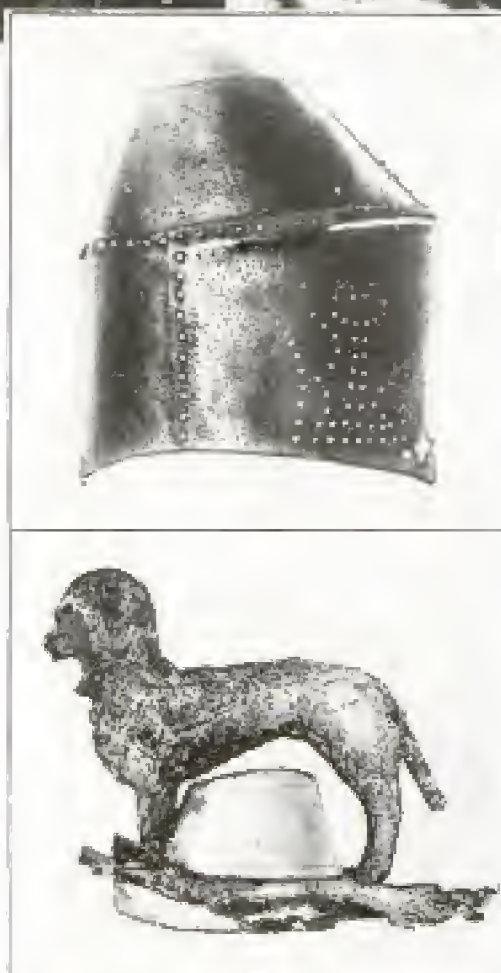


Courtesy Harry Peck
Center, Microphotograph of Linen Cloth from Old Tomb; Below, Restored Cylinder of Sennacherib



old, which had been dug up from a ruined, dead city in the Orient, was being carefully guarded by British Museum experts, who thought it might solve some mystery of a vanished race. To decipher it, however, the scroll had to be unrolled—and the ancient leather crumbled to dust when touched. What to do? It seemed an impossible task. Yet, after numerous fruitless experiments, the curators devised a means of treating the leather with cellulose to give it body. At last, the scroll was unwound and deciphered—only to learn that it was merely the writing exercise book of some student in ancient times.

From the Irish Free State government recently came a thousand-year-old sword of a Viking pirate, discovered in a bog. When found, it was a shapeless mass of rust, but after prolonged chemical treatment it was converted into a fine weapon, showing clearly even the



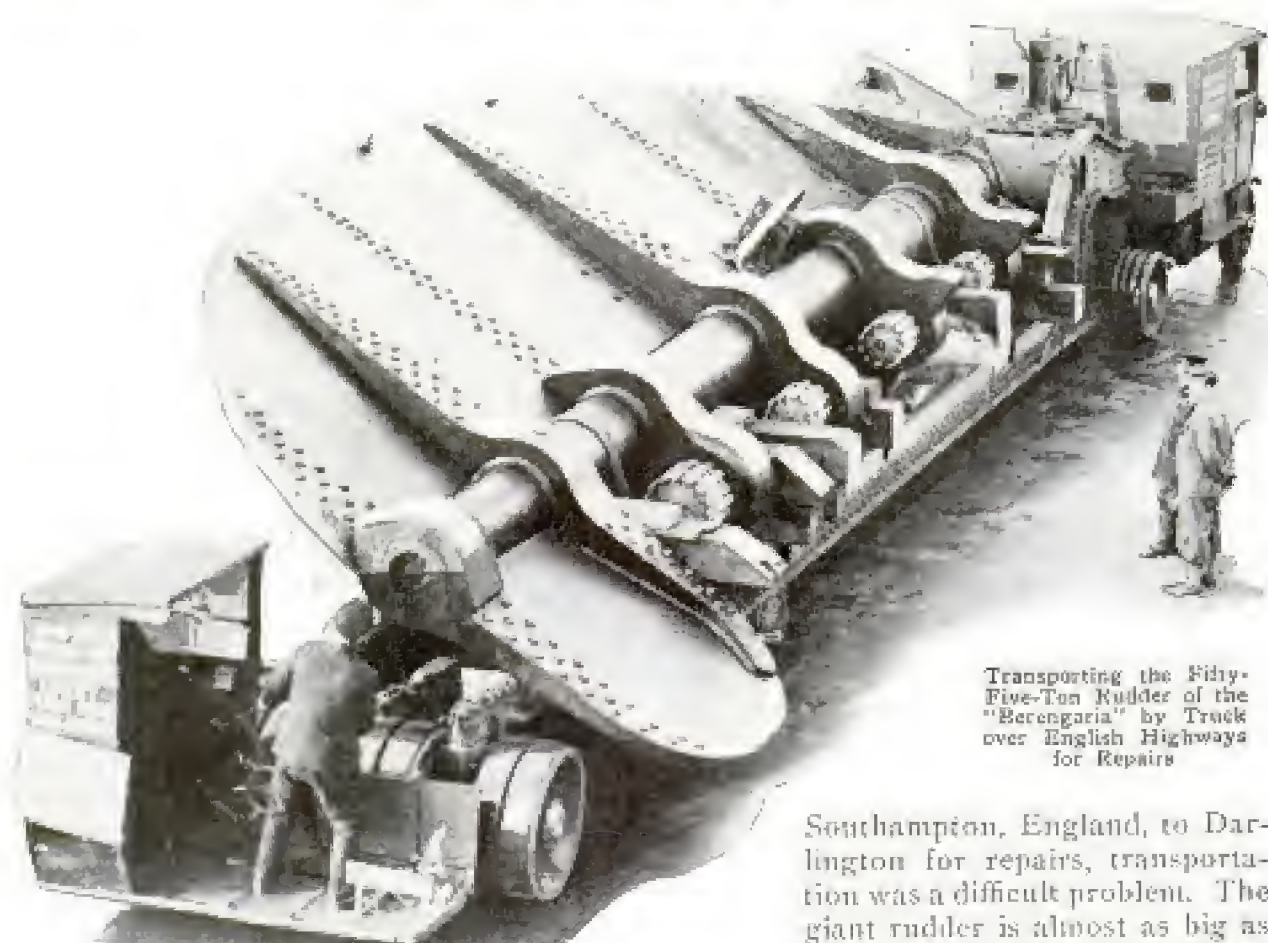
Courtesy Dr. Alexander Scott
Top, Example of How a Discolored Print Was Cleaned with Hydrogen-Peroxide Vapor; Below, Restored Helmet and Its Ornament

runic writing engraved on the blade.

Sometimes, genuine antique art treasures play queer tricks of their own. For example, the Napoleonic snuff box that actually exploded while on display in the British Museum.

The quiet of the noon hour was shattered by a crash of broken glass. The startled attendants found that a beautiful painted snuff box, made of gold and enamel and studded with jewels once owned by the Empress Eugenie, had exploded. No one was in the gallery when the delicate box blew up. The guards were amazed, but not the curators of the museum. They examined the fragments under a powerful microscope and ascribed the cause. Enamels are

glass, and when chilled from the molten state, molecules sometimes remain in a state of high tension, until upset by some trifling change in conditions. Then the object suddenly disintegrates.



Transporting the Fifty-Five-Ton Rudder of the "Berengaria" by Truck over English Highways for Repairs

Wide World
**SHIP'S RUDDER BIG AS A HOUSE
TRANSPORTED BY TRUCK**

When it became necessary recently to take the fifty-five ton rudder of the liner "Berengaria" a distance of 316 miles from

Southampton, England, to Dartington for repairs, transportation was a difficult problem. The giant rudder is almost as big as a house and its length would not permit hauling it by rail. The matter was solved finally by loading it on a truck so long that a telephone was strung between the driver in front and the one in the rear. This vehicle and its load took up the whole road, and placards were placed on the rudder telling what it was.

B899
**SECRETS OF SEA TO BE SHOWN
BY USE OF DYNAMITE**

65 Broadway
Secrets of the sea floor's structure can literally be blown out of it by the use of dynamite. This is the opinion of Dr. E. L. De Golyer, New York geologist, who believes the secrets of the sea can be brought to light by the use of prospecting methods such as were employed to develop the Gulf coast oil fields. These methods depend on the fact that earth waves, whether due to natural earthquakes or to the detonation of explosives, travel faster in dense rock and more slowly in loose soil or sedimentary rock. Such methods have been successful in locating salt domes off shore in water as much as thirty feet deep, and it is now believed that explosives can

be used successfully in determining geological formations in waters of much greater depth.

B-82
**TREE GUARD FOR BIRDS' NESTS
FITS AROUND TRUNK**



Birds' nests in trees can be protected from cats and other animals by an umbrellalike tin guard that fits around the trunk. Since the guard

is set at a downward angle, the animal climbing up the tree is unable to pass it.

Used by Mrs. Homer Bair, Kansas City, Mo.
Copyrighted material

Urbania Ill
**LANDSLIDES ON OCEAN FLOOR
MAY ENDANGER SHIPS**

Warning to navigators not to trust their echo-sounding devices too implicitly when crossing great valleys of the ocean floor has been issued by Dr. Francis P. Shepard of the University of Illinois, who has made a study of submarine land movements. He also suggested that cable companies avoid laying lines across such valleys if they are known to be geologically unstable. Along the margins of continents lies a submerged area known as the continental shelf under relatively shallow water. This is really a part of the continent to which it is attached, and was once dry land, with rivers flowing through it. In the course of time the land has sunk, and the valleys have been filled with debris, piled up in rather loose masses. If an earthquake should shake such a formation, it might move out in a great submarine landslide, leaving the valley much deeper than before. A recent case of this kind occurred, apparently, when a landslide swept out the bottom of a "lost" submarine valley, forming the newly discovered Corsair gorge off the coast of Newfoundland.

**TRIGGER FEEDS SOLDERING GUN
HEATED BY BATTERY**

By pulling the trigger, solder is fed to a new electric soldering iron that looks like



When This Soldering Iron Is Hot, Pulling Trigger Releases Solder from Barrel

a pistol. The iron is operated from a six-volt battery. Solder is pushed through a channel in the gun to the tip of the iron, where it is hottest. All operations can be carried out with one hand. Soldering from below is also possible.



Use for Old Razor Blades; Put Them in as Cutting Edge for This Handy Lawn Trimmer

**TRIMMER FOR EDGES OF LAWN
USES OLD RAZOR BLADES**

Edges of the lawn can be cut neatly with a small grass trimmer that uses old razor blades as its cutting device. A rotating brush picks up the edge of the grass and holds it against the sharp cutting surface, trimming the grass along the walk and similar places where the lawnmower can not be used. The trimmer weighs only two pounds.

**SOME OF RACES "LIVE FASTER"
THAN OTHER GROUPS**

Some races have been found to "live faster" than others. The rate at which certain vital-energy interchanges go on in the human body varies with different racial groups, according to Dr. Francis G. Benedict, of the Carnegie Institution. He studied measurements of the heat production which accompanies these changes in Mayas in Yucatan, in pure-blooded aborigines of south Australia, in groups from Madras and pure-blooded Chinese girls. He found wide differences in the heat production of these groups, which could not be explained entirely on account of differences in size, dietetic habits, climatic conditions or sex.

And of business. 2/6/35

Manufacturers Research
at Nutritional Laboratory
Washington D.C.
Chicago

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Nutritional Laboratory
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Boston Mass

POPULAR MECHANICS
Anderson, and



That Tree-Climbing Instinct Is Satisfied by This Pole That Bends under Boy's Weight

CLIMBING POLE FOR CHILDREN IS SAFE EXERCISER

All the fun and exercise of climbing trees is offered by a "monkey pole" for use on playgrounds. The pole, made of metal, is safer than trees. Rubber-covered handgrips are spaced along its twelve-foot length, while heavy coil springs and a shock absorber are inclosed in a sheet-metal hood. The climbing child's weight at the top bends the pole toward the ground. When the child releases the pole, it returns to the upright position.

POISON IVY IS MOST VENOMOUS WHEN LEAVES ARE YOUNG

Poison ivy is at its worst when its leaves are young. James B. McNair of the Field Museum of Natural History, says that this

form of poisoning is most prevalent in the spring, when the leaves are expanding and when the poisonous resin is rising in the general sap stream of the plant. Refuting the belief that the pollen of the ivy is poisonous, he points out that a person can be poisoned only by touching the ivy or something that has been brushed against the plant's leaves. The poisonous substance cannot travel through the air. The best remedy is iron chloride to the extent of five per cent in a half-and-half mixture of alcohol and water. This is effective only if applied in the early stages of poisoning. Hands and face should be bathed freely in the solution immediately after a person goes into a region known to contain the ivy or kindred plants.

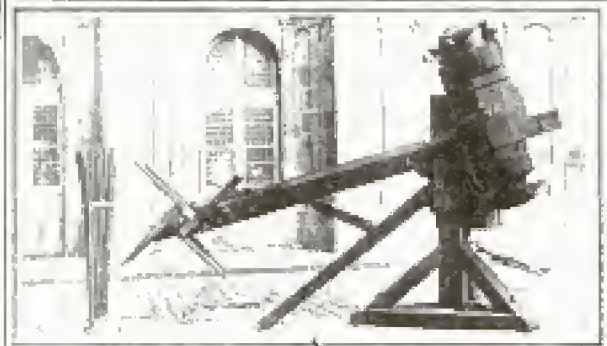
B877
SPRING STENCIL WITH ROLLER PRINTS PERFECT COPIES

By suspending a stencil and ink pad on springs to form contact, a duplicator that produces perfect copies by running a metal roller over the stencil has been devised. The roller acts as a cylinder to the suspended stencil and pad, resulting in the same action as a cylinder machine, although in this new duplicator, the effect is obtained by flexing the stencil. The frame containing stencil and ink pad is detachable from the base and becomes a portable printing unit for work on bags, boxes or large packages. Regular stencils are used in producing exact copies of anything typed, written or drawn.



This Duplicator Uses Spring Stencil and Roller in Copying Printing, Writing and Drawing

Hayer Duplicator Co
 906 Jackson Blvd
 Chicago



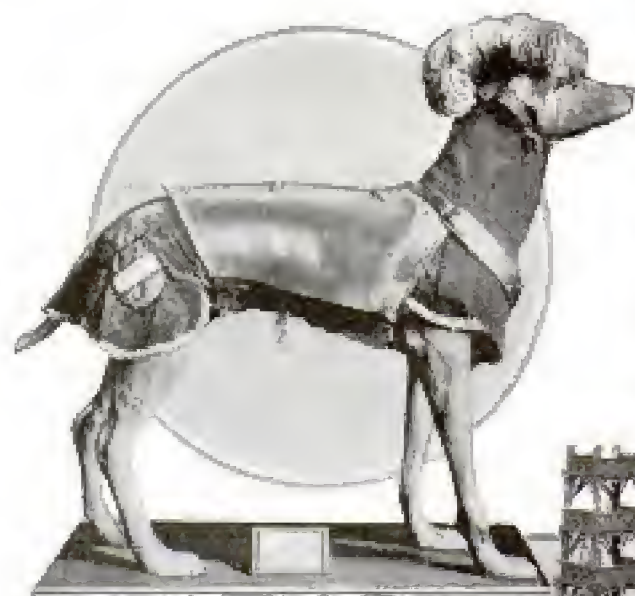
New Weapons of War Only Improvements on Ancient Arms

WHILE the eventual disarmament of the world is the hope of many leaders attending the conference at Geneva, investigation reveals that practically all the present methods of destruction are in truth merely improvements of very similar things used by the ancients.

Early Persian "tanks" consisted of armored elephants with scythes fastened to their trunks. Their airplanes were flocks of fierce falcons trained to fly into the face of enemies, clawing at eyes and features. The Babylonians and Carthaginians had liquid fire similar in deadly effect to our poison gas. The armored dogs of the

Top, Drawing by the Historian and Artist, C. Briou, Depicting Gauls Attacking Roman Defense before Alesia; Below, Long Range Guns of 52 B.C.; the Top One Fired Huge Spears Half a Mile, the Center Worked Like a Sling, Throwing Stone Balls, and the Lower Is a Wooden Tower Rolling on Wheels, the Ancient Tank



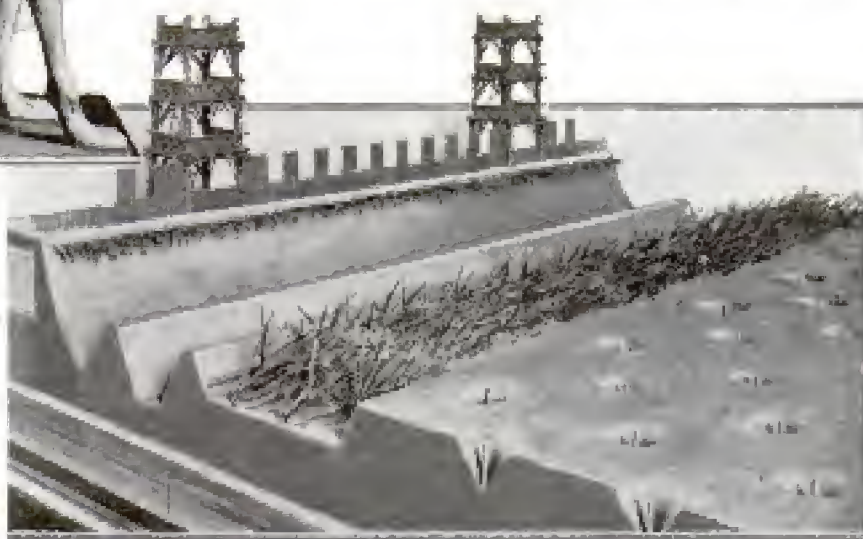


Babylonians were tremendously effective.

There have been recently completed two collections dealing with armaments used in past ages. The first has been assembled by Salomon Reinach and associated French scientists. It is housed in the museum of St. Germain-en-Laye and consists of reconstructions of the long-range "guns," trenches and "barbed wire entanglements" used by the Romans in their conquest of Gaul in 59 to 51 B.C. The second, and still more important and costly, collection is that made by General Mariaux, of the French army. He has gathered together, and housed in the Invalides, the largest number of varied cannon in the entire world. They are from every age and country.

The chief armaments used by the Romans were the onager and ballista, the former comparing to our light field artillery, the second to our longer-range guns. The onager consisted of a throwing arm of very hard wood to which was attached a sling which held a stone ball about the size of a man's head. The tension for the throwing arm was obtained by rope on a drum, and to secure impetus, the arm struck against a padded cushion. The ballista was a much heavier wooden framework upon which was mounted a crossbow of enormous power, the tension of which was obtained by windlass and cogwheel

arrangement. The ballista threw long spears of hardwood a distance of nearly half a mile. Caesar perfected a line of defenses which have not been improved upon to this day. First there was a line of holes in the center of each of which was fixed an upright sharpened stake. Each of these was flanked by another hole with a stake with an iron top shaped like a fishhook. Once caught in these, a man was easily dispatched. Closely backing these lines was a stretch of closely set branches with



Above, Armored Dog of Type Used in Ancient Warfare; Below, Models of the Lines of Defense Used by Romans in Siege of Alesia

sharpened points (the barbed wire entanglements). The branches faced directly upon two lines of moats, one dry, the other filled with water when a stream could be diverted. The moats gave directly upon a sloping wall of hard earth, from the top of which sharpened stakes projected at right angles. Above the earthworks was mounted a wall of wickerwork, with towers at intervals of seventy-five feet from which to hurl down missiles.

The second collection consists of some 1,500 cannon, ranging from the first primitive gun fired by wedge and hammer, to the latest anti-aircraft gun. It is indeed an amazing bringing together of the most interesting types of armament.

With the coming of gunpowder the whole art of warfare was transformed. The most unusual cannon is one cast in 1480 for the taking of Jerusalem. It weighs three tons, and shot stone balls two and one-half feet in diameter. Cannon in the early days, and even in the last war, as witness "Big Bertha," had individual names,

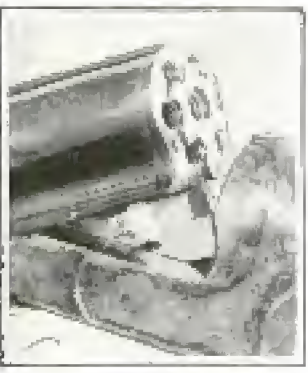
B839

A great many of them were magnificently wrought and had various mottoes. Probably the finest one of this sort ever cast is "The Snake" made in France in the sixteenth century. In addition to a magnificent serpent wrought upon the barrel, the handles are formed by Adam and Eve embracing, the whole symbolical of the fall of man, which made war and cannon a part of the changed scheme of things.

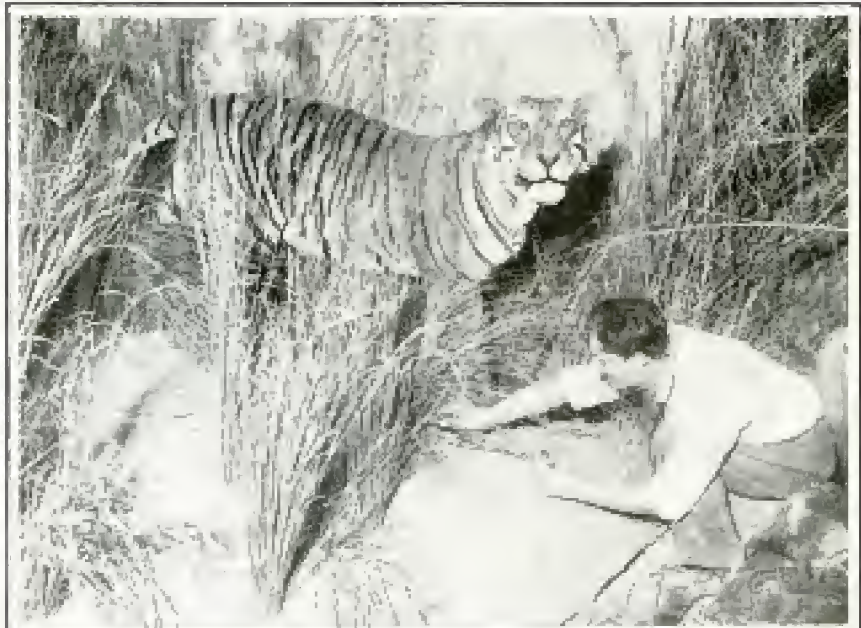
So in these two great museums stand gathered silent reminders of armaments of the past, symbols of destruction, on which ban is now sought.

SEVEN-BARREL GUN FIRES ALL SHOTS AT ONCE

Firing seven high-speed bullets at the same time, a .22-caliber rifle, designed especially for guarding banks, has been produced. The rifle, with its seven barrels, is called the deadliest small-caliber gun in the world, since it has an approximate range of one mile, is accurate enough to hit a man at 500 yards and places all seven bullets in a thirty-five-inch pattern at 100 yards. The seven twenty-six-inch barrels have automatic ejectors for throwing out the empty shells in order to speed up loading. When used for hunting, the rifle will kill any animal up to and including such as are the size of deer.



Castor oil and coal tar form the bases for certain sweet-scented perfumes.



Top, Arranging Grass around Feet of Lifelike-Looking Tiger; Bottom, Eyebrow Pencils and Brushes Make Animal Exhibit More Natural

DARKEST INDIA IS BROUGHT TO HEART OF GOTHAM

Ferocious tigers, crouched to spring from the tall jungle grass, stare back at New Yorkers who venture into the American Museum of Natural History. Surrounded by the rocks and foliage of their native habitat in India, these great beasts have a realistic appearance, even though in glass cases. Magnificent skins of tigers and other wild animals, after being chemically treated, are stretched over perfectly sculptured models of the originals. The figures are then placed in lifelike poses in settings of trees, grasses and reeds brought direct from India or fashioned from paintings. Completed figures of the beasts are brushed carefully to give their coats a natural sheen. Even eyebrow pencils are used to make the animals more lifelike.

1899 N. Clark
not on telephone - Surkhamer's been it hope.
made by J. Surkhamer,
54 W. Randolph
Chicago

B3698 Messrs Hartmann York Ave # 664
und Braun New York
112 POPULAR MECHANICS
Frankfurt am Main

Cmt. Oene Leonhardt, 11-A, Chmnenweg,
Berlin. Heglitz, Germany.



This Meter, Attached to Power Rail, Shows Whether Current Is Escaping through Some Other Conductor

ELECTRIC LEAKS ARE TRACED WITH DETECTOR

Escaping electricity is detected in improperly jointed rails by an instrument developed in Germany. The detector, applied to the rails, shows whether the current passing through the joints meets with abnormal resistance. If the conductivity is found to be faulty, the defective joint is repaired by welding on copper straps, which help the power over the joint. When the tracks of electric railways are not properly joined, or bonded, the conductivity is poor, and the current seeks a path through surrounding soil or other conductors, causing their corrosion.

GERM OF INFANTILE PARALYSIS ENTERS THROUGH NOSE

Infantile paralysis has been found to be essentially a "smelling disease." The germ or virus causing it is not carried by lower animals but is confined to man and enters

the body chiefly through the nose, passing along the nerves of smell to the brain and spinal cord, where its main attack is made. These conclusions have been reached by Dr. Simon Flexner, director of the Rockefeller Institute for Medical Research. The chief avenue of escape for the germs is likewise by way of the nasal membranes, indicating that nasal secretions may be the means of spreading the disease. Monkeys can be protected for comparatively short periods by inoculating with blood serum from human beings, who have recovered from the disease, from other monkeys given the disease experimentally, or from certain persons not known to have had the disease but whose blood nevertheless gives protection against it. Lasting immunity can be given monkeys by inoculations of the paralysis virus or germ itself, but immunization of man has not been tried because in some cases with lower animals, the method has resulted in paralysis.

WORLD'S SECOND BIGGEST BELL EAST FOR CARILLON

Iron notes from the second largest tuned bell in the world will be heard from the carillon at the University of Chicago. The bell, made at an English foundry, is ready for shipment to the United States. The largest tuned bell now hangs in the belfry of the Riverside Church in New York.



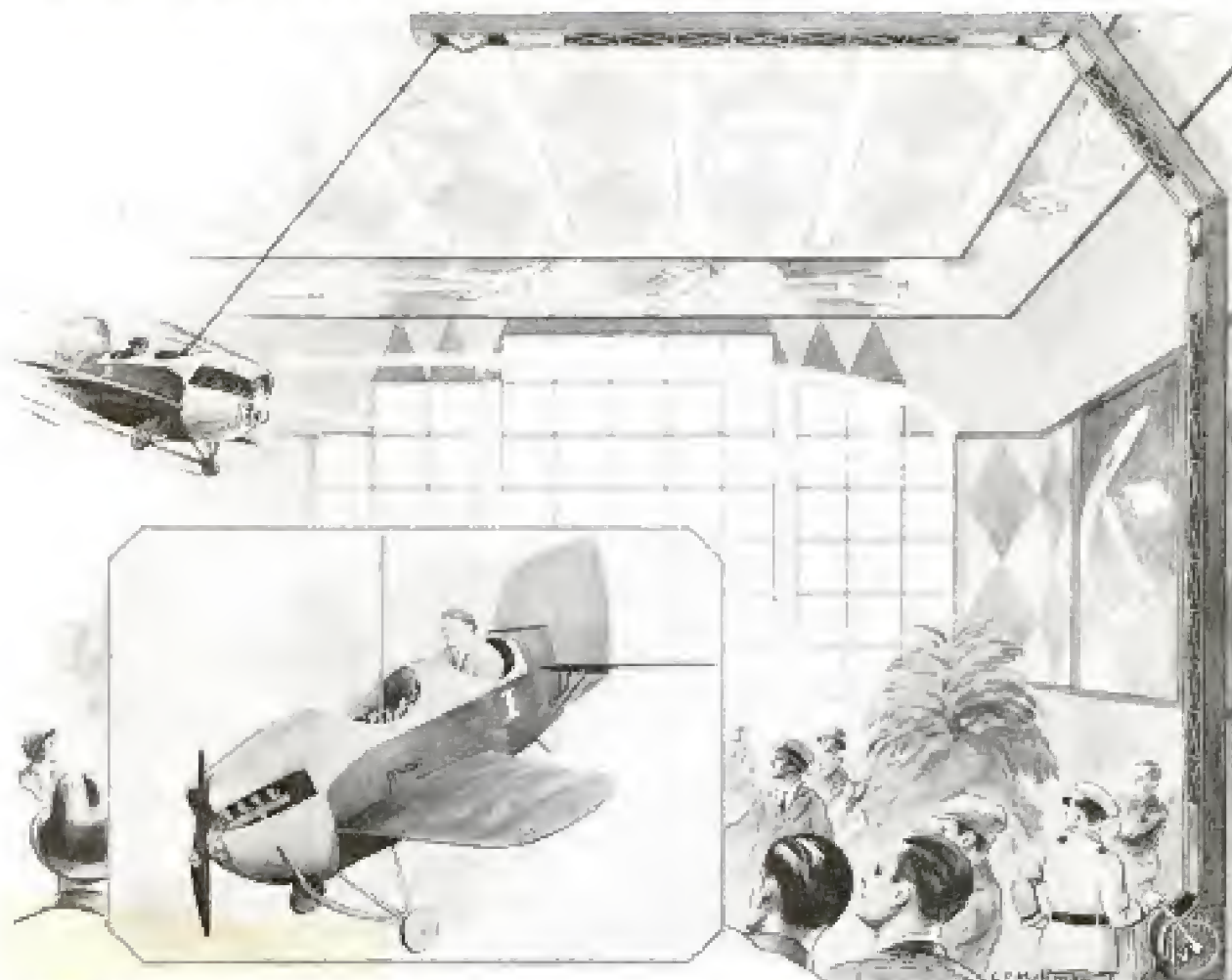
This Bell, Second Largest in the World, Will Ring When Carillon Is Played in Chicago

B643 Alva A. Busch, 76 Busch.
Rocco Auto Service,

POPULAR MECHANICS

335 E Pershing Road Chicago 13

Plane on Cable Does Anything Except Crash



Flying Experience in Perfect Safety Can Be Obtained in This Plane Supported by a Cable; Large Drawing Shows How the Craft Operates; Inset, Close-Up of the Training Device

With motor roaring and the "joystick" moving all controls at will, the student airman may experience every sensation of flight in perfect safety with a training plane developed by a Chicagoan. The craft is suspended by a cable from the roof of a large building or outdoor frame. It is complete in every detail, save that the short wings have no lifting power, acting rather as ailerons. All the other controls are in place, moved by the stick in the pilot's compartment. The front seat is not a seat at all, but contains a hook for the cable. Perfect balance has been attained so that the pilot, by leaning forward or backward, may point the nose of the plane down or up. Every movement of a plane in the air is possible, with the exception of high speed forward. Pulleys are used to draw in the cable after the pilot is seated, lifting the craft off the ground or floor. A twist of the propeller starts the small

four-cylinder motor, whose speed is controlled by throttle. While the craft is especially adapted to training purposes, it also is designed as an amusement device.

PATENTS ON FOUR NEW FRUITS

Four new varieties of fruit developed by the late Luther Burbank have been protected by recent patents. Three of these cover plums whose distinguishing characteristics are unusual size and taste, thin skin, resistance to deterioration in shipping, and early ripening. The fourth patent covers a freestone peach, weighing one-half pound on the average, that ripens halfway between the early Alberta and the June Alberta peach. The patents, among the first to be issued by the plant and fruit division of the patent office, have been assigned to a Missouri nursery by the widow of the plant wizard.

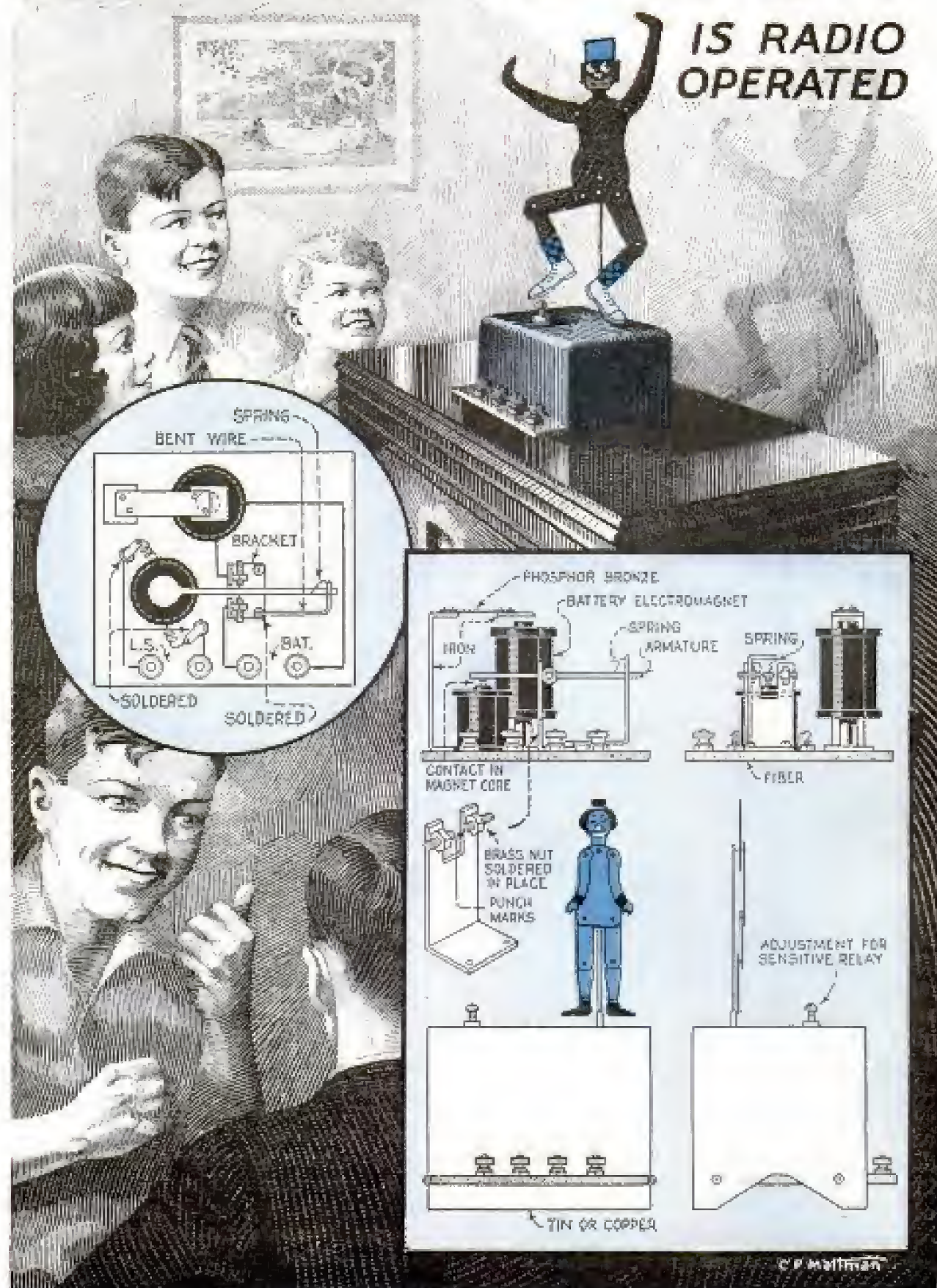
W. S. Starb 4/4/52

Copyrighted material

B760
Starb Bros Nursery
and Orchards Co., Louisiana, Mo

DANCING TOY

IS RADIO
OPERATED



Dancing Toy Is Radio Operated

Operated by the pulsating current peaks in the output of a radio receiver, this dancing toy amuses the children and mystifies the grown-ups. A sensitive-relay arrangement makes the little paper doll dance in time to the music. The base should be of insulating material. A 1,000-ohm magnet may be taken from an old telephone receiver or purchased from any electrical supply house. The armature for this relay is cut from light sheet iron and two phonograph needles are soldered end to end to form a balanced shaft. The bearings for this shaft are made by punch-marking the ends of the 6-32 brass machine screws that are mounted on the bracket. A tiny hole is drilled in the end of the armature to hold a small silver contact. This contact is in alignment with another silver contact in the core of the relay magnet. This contact should be filed down almost flush with the surface of the core. A small piece of No. 28 spring wire is used to keep the relays in normal position. This spring is soldered to a larger wire and bent as shown, to adjust the spring. The magnet terminals are brought out to the speaker binding posts as indicated. This relay makes and breaks the circuit to the actuating relay, which consists of an electro-magnet of the 5-ohm battery-operated type and may be purchased for a few cents. The cardboard dancing figure rests directly on the armature of this relay and should weigh about 1 oz. The cover may be made of metal or wood. Where the wire supporting the figure passes through the box, a small metal tube, about 1½ in. long, holds the figure upright. The screw for adjusting the battery-relay armature is mounted on the outside of the box, so that the end of the screw will make contact with the top of the armature. One or two dry cells in series will operate this relay. Any modern receiver with power enough for a dynamic speaker will operate the toy. If sparking at the contacts of the relays causes too much noise in the receiver, it will be necessary to connect an inexpensive 4 to 6-mfd. condenser across these contacts to absorb the spark. The device is connected in series with the loud speaker. The adjustment is critical, but when once set for the normal volume of the receiver, no change should be needed.



Switch-Operated Coils
Covering Short-Wave Range
from 16 to 185 Meters

Short-Wave Converter Is Self-Contained

No plug-in coils are required for this a.c. short-wave converter that changes any standard a. c. broadcast receiver into a short-wave superheterodyne. It is said to be simpler to operate than the conventional short-wave receiver, owing to the facts that there is no regeneration control and the oscillator circuit may be logged. The tubes employed are one 224, one 226 and one 235. A special switch permits the use of the converter or the broadcast receiver at will without changing any connections. The selector knob is color-coded for the various short-wave bands.

High-Voltage Condenser in Tank Form



Oil-filled high-voltage condensers in tank form are now available at prices within the reach of amateur experimenters. These condensers are said

to be proof against breakdown under any conditions, and are built to operate at extremely high voltages.

John H. Hentchman & Co. Corp.
Cambridge, Mass.

Chas. Hoadwin Co
4240 Lenox Ave

Chas. Hoadwin Co



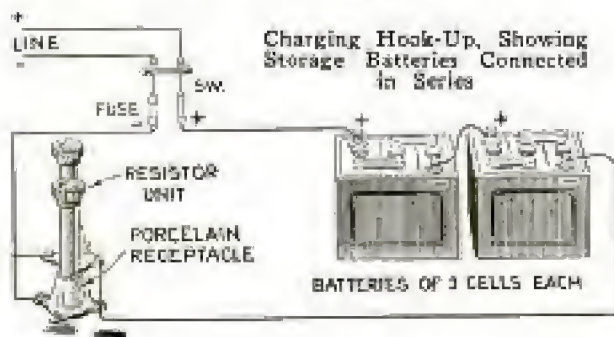
Auto Receiver, Showing Compact Arrangement of Parts and Bolts for Mounting

Mounting Bolts Built into Chassis of Auto Set

Rigid mounting bolts hold this compact six-tube auto receiver to the fire wall, or bulkhead, below the dashboard of the car. The speaker is a dynamic type and is usually mounted on the same wall directly in front of the steering column.

Charging Batteries from D.C. Line

Storage batteries may be charged directly from a 32 or 110-volt d.c. line if suitable resistors are used as shown in the diagram. The resistors for this purpose are now available with Edison screw-base mountings that fit into standard lamp sockets. The units for charging from a 32-volt line are 6.4 ohms each, and one will handle up to three cells. Two units, connected as shown, are necessary for two storage batteries consisting of three cells each. The units for a 110-volt line are 62 ohms each, and three are required for any number of cells up to seven. Four units will handle up to 10 cells and the charging rate in all cases will be 5 amp. No. 14 copper wire is used for the connections, and line fuses should be employed together with a switch in the supply line.

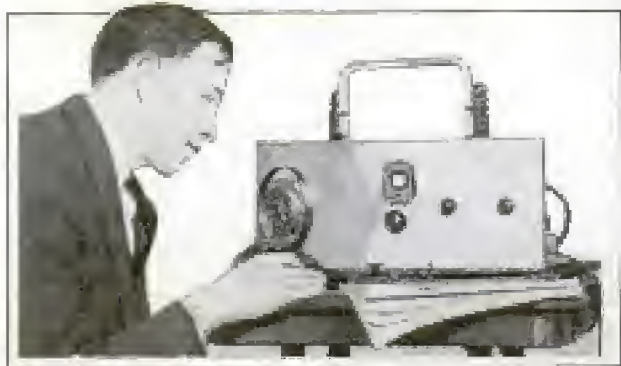


Practical Radio Shielding

Careful shielding, especially in the construction of short-wave sets and in the r.f. stages of broadcast receivers, is of great importance owing to the nature of the new tubes now in common use. Sheet tin, having a slight copper content and known as "copper-bearing," may be obtained at most hardware stores. This material is easily bent and soldered for any type of shielding required. The losses incurred by the use of this material will be negligible for all practical purposes, provided the coils are placed at a distance not less than their own diameter. Direct copper wire connections should be used for radio circuits. To be effective, all shields should be grounded, and this is a simple matter if a metal chassis is used. For breadboard layouts, a sheet of this metal may be used to cover the baseboard.

Code by Sight Instead of Sound

A gas-filled tube makes dot-and-dash signals visible to a member of the Tacoma, Washington, amateur radio organization who recently lost his hearing as the



Short-Wave Receiver Equipped with Neon Tube for Visual Signals

result of an accident. The idea was obtained from watching the blinker-light signals on a battleship. A neon tube is used instead of the speaker or phones much in the same manner as a neon lamp in a television receiver. With practice, the deaf member hopes to attain the same receiving speed that he possessed before the accident.—J. Bashford, Tacoma, Wash.

For further information on any radio construction article write to the radio department; this service is free.

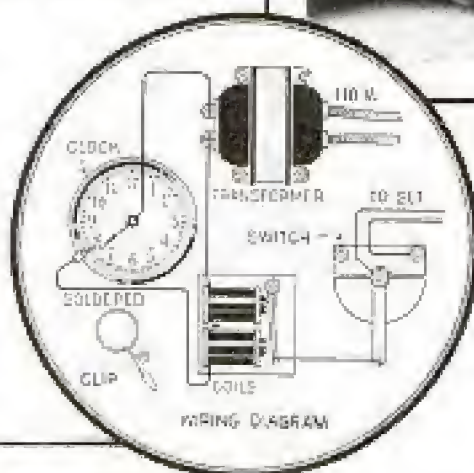
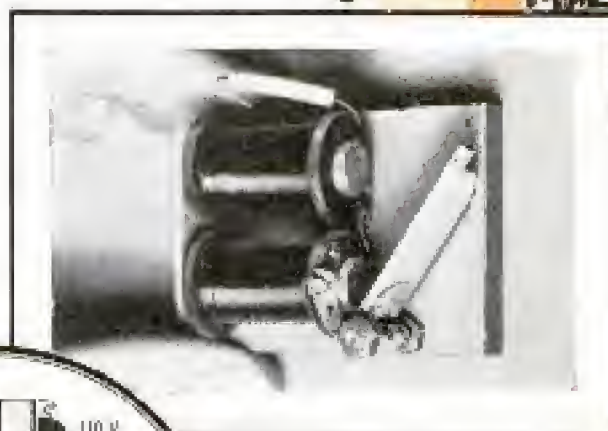
SELF-TIMER

Turns on Radio

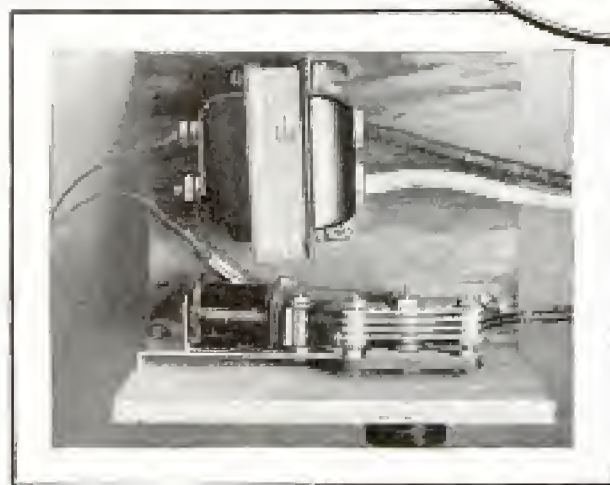
By W.E. BURTON

THIS self-timer for your radio receiver is a convenience that you can provide at little cost and a few hours of fascinating work. It will turn the set on in time for you to hear any given program. It will operate as many times a day as you desire but the receiver must be turned off by hand. It would, of course, be possible to do both of these things automatically, but the equipment required would be complicated. The timer does not interfere with the receiver if it is already in operation when a setting is reached by the clock.

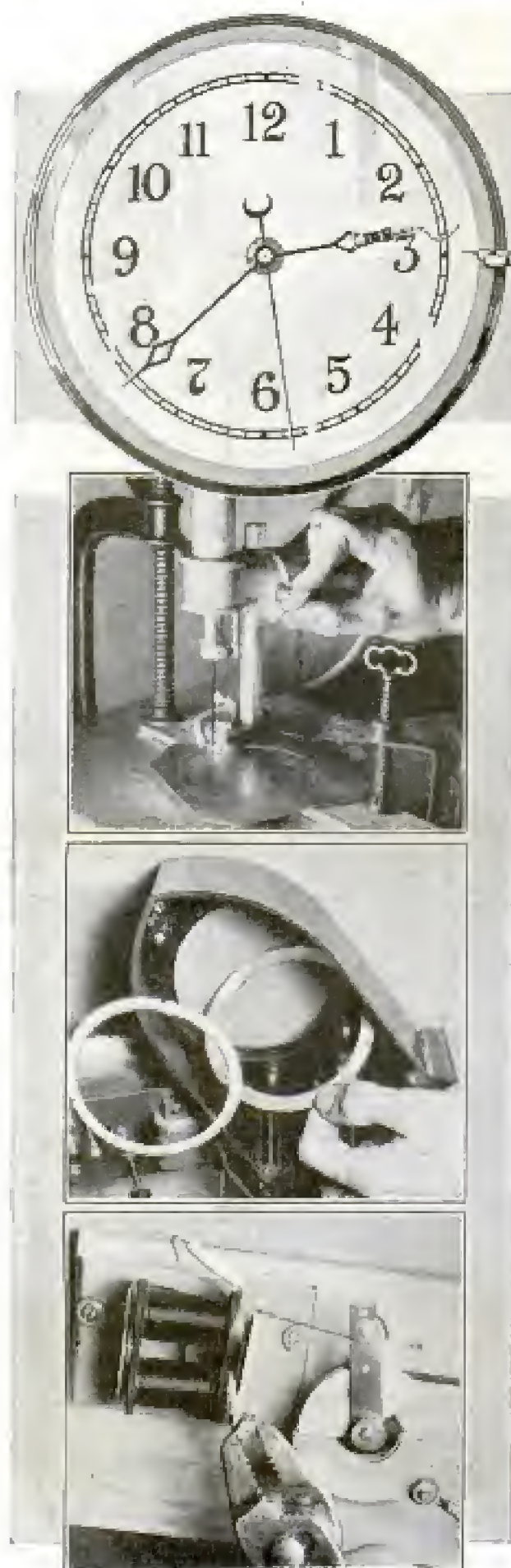
A small electric clock, a doorbell transformer, a set of bell magnets and a few odds and ends are required. A 25-cent doorbell will supply the necessary magnets. All of the base, on which the magnets are mounted, is cut away with the exception of a rectangle of metal directly beneath the coils. The vibrator, or armature, is removed and the spring, on which it is mounted, is replaced with a hinge arrangement so that it will swing easily in about the same position that it formerly occupied. This detail is shown in the center photo



on this page. The unit is mounted on a piece of wood, about $3\frac{1}{2}$ by 5 in., and this assembly becomes the front panel of the control box upon which the clock is placed. The exact dimensions of the box depend on the size of the parts used.



Before mounting the magnet armature permanently, a small hole is drilled near the free end to receive a wire link that connects the armature with the switch arm. The switch is nothing more than a midget variable condenser. The stationary plates are bent together so that the rotor, when turned toward the magnet in the position shown in the lower photo, will make contact with them. The plates are adjusted so that a very slight turn of the rotor will make good contact. A stiff wire link, made from a straightened paper clip,



joins the magnet armature to the condenser-switch rotor by means of a small metal arm fastened to the rotor. The relative positions of the magnet, armature and switch should be such that a slight movement of the armature toward the magnet will close the switch. A small nail driven into the panel provides a stop that limits the swing of the condenser plates in the opposite direction.

The doorbell transformer is mounted on a baseboard with the panel at front, as shown at the lower left on page 117.

A spring-driven clock could be used, but the electric ones are quite inexpensive. In either event the clock should have a round face and a bakelite case. The clock works are removed and the crystal discarded. A ring of brass, aluminum or copper is cut in the manner indicated in the photo so that it will fit snugly inside the depression provided for the crystal as shown below. The notches are cut for passing the retaining lugs. The distance from the outer to the inner circumferences of the ring is such that about $\frac{1}{4}$ in. of metal will project beyond the case, covering a narrow strip around the dial. An insulated wire is soldered to the ring and led out through a slot cut in the ridge for connection to the coils. A paper ring whose outer edge coincides with that of the metal ring, but whose inner circumference is larger, insulates the metal ring from the clock dial.

The hands of the clock are removed, and a thin strip of phosphor bronze, or spring brass, is fastened to the hour hand. A brush of very fine wire is now fastened to the end of this strip.

A number of little clips, shaped as shown in the diagram, are made of fairly heavy phosphor-bronze shim stock and slipped over the metal ring around the clock face, their lower ends projecting down but not touching the dial, so that the brush will just touch them as it passes. These clips are set for different program periods.

The circuit is completed through the clock works when the hour hand touches any clip. The condenser switch is connected across the radio-receiver switch so that the receiver can be operated by either. A switch in series with the transformer primary will permit turning off the timer without removing the clips from the clock.

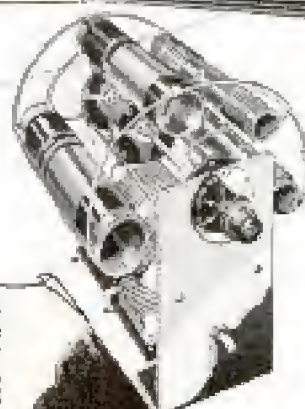
*American Plywood Corp
New London, Wis
ref. ing. to 7*

*Conrad Radio Corp
21 W. 17th St. N.Y.C.*

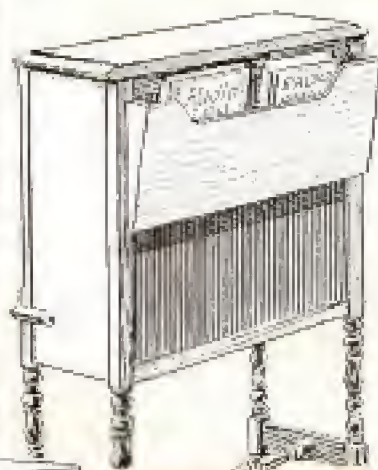
Radio Problems Simplified



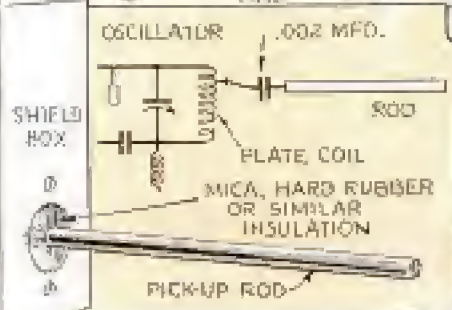
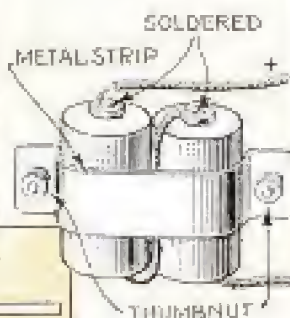
Antenna Built into Electric Clock Solves Radio-Installation Problems in Apartment Buildings or Where an Outside Antenna Is Not Practical; Right, Short-Wave Superheterodyne-Coil Assembly, One Four-Position Automatic Switch Covering the Entire Short-Wave Band; These Units Are Also Available for the Construction of All-Wave Receivers



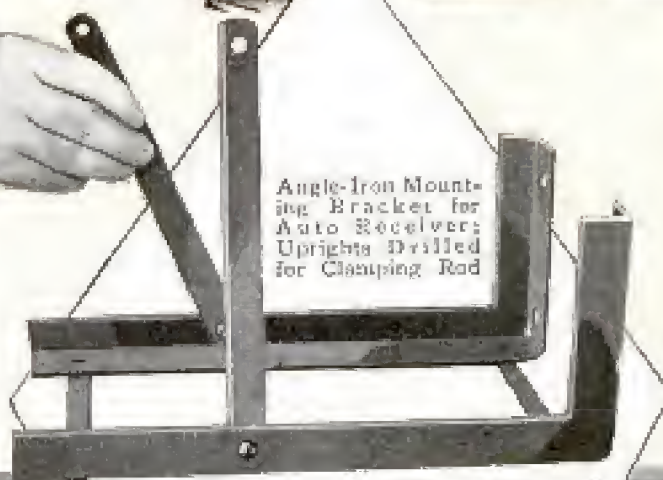
Below, Center-Punching Hole Locations on Metal Panel to Insure Accurate, Clean-Cut Holes



Handy Shelf for Radio Logs and Reference Books Located at Rear of Console; Below, Metal-Strip Mounting for Flashlight Cells in Portable Sets



Brass Pick-Up Rod Mounted on a Portable Oscillator for Coupling the Unit to the Receiver for Balancing Stages; One End of the Rod Is Threaded for the Insulated Mounting Panel Located on the Side of the Metal Container; the Coupling on the Plate Coil Is Adjusted with a Clip; Oscillator Will Retain Its Calibration Despite Rough Handling; Also Useful for Monitors



Angle-Iron Mounting Bracket for Auto Receivers; Uprights Drilled for Clamping Rod

Modern PENTODE and SET SUPPLY



PART I

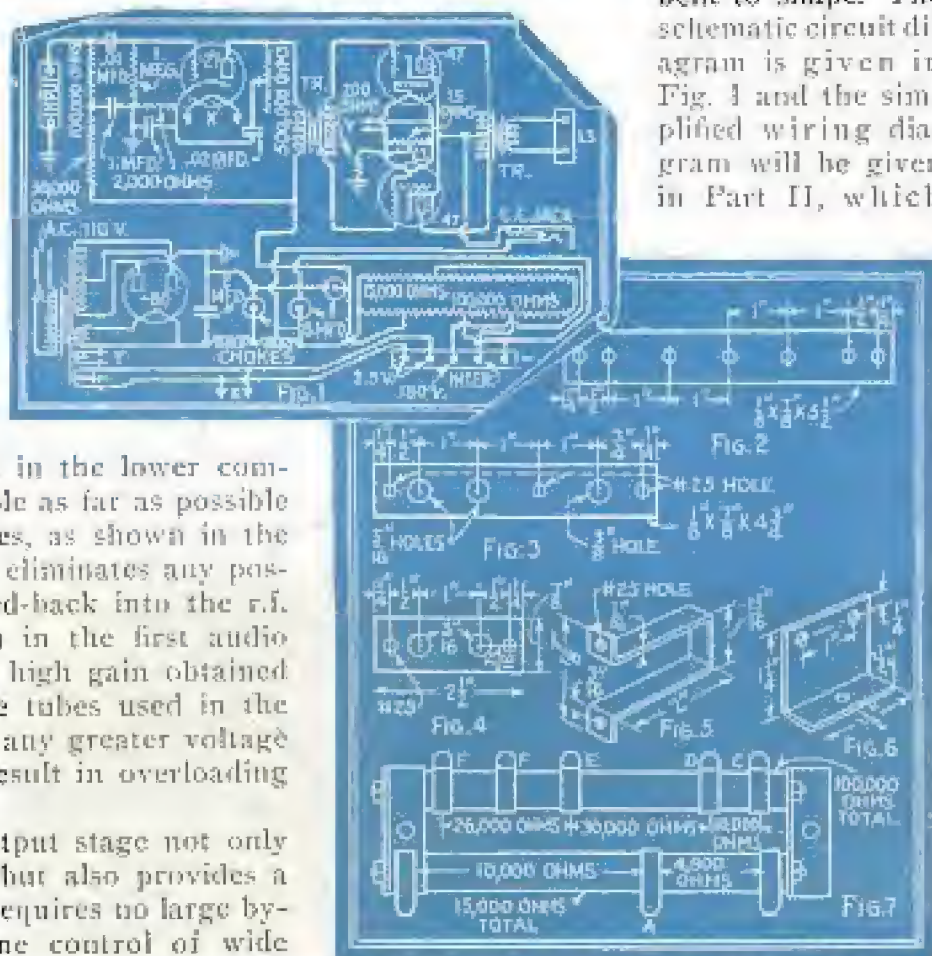
BUILT as a separate unit, this power amplifier also supplies the filament and plate voltages necessary for the operation of any a.c. receiver. Resistance coupling provided for input enables the set builder to use the amplifier after any type of detector. The power unit can be placed in the lower compartment of the console as far as possible from the tuning stages, as shown in the drawing above. This eliminates any possibility of hum or feed-back into the r.f. stages. The low gain in the first audio stage is offset by the high gain obtained from the two pentode tubes used in the output stage; in fact, any greater voltage amplification would result in overloading these tubes.

Push-pull in the output stage not only supplies great power but also provides a balanced circuit that requires no large bypass condensers. Tone control of wide

range is also included in the circuit. The amplifier voltages are supplied by an independent divider so that varying loads do not affect them appreciably. A simple means is provided for the selection of the necessary voltages to be supplied to the r.f. and detector stages. The 2½-volt supply terminals will feed five heater-type tubes, and the center of this winding is grounded in the unit.

The construction details for the metal chassis are supplied on a mimeograph sheet together with the material list, which is available to all upon application. The chassis is made from a sheet of aluminum, 19½ by 10½ by ½ in. thick. The drilling is all done on the flat sheet before it is

bent to shape. The schematic circuit diagram is given in Fig. 1 and the simplified wiring diagram will be given in Part II, which



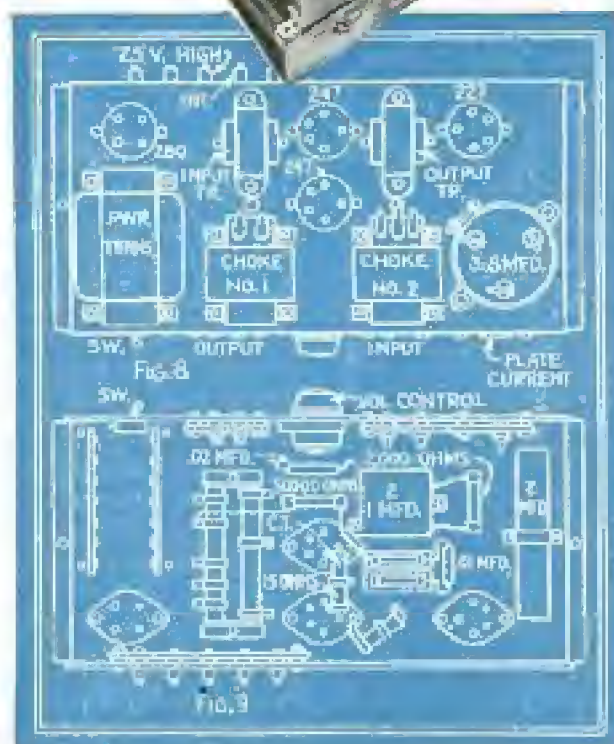
AMPLIFIER

By S. H. BURNS

will follow in the August issue

The terminal strips required are shown in Figs. 2, 3 and 4 and are made from $\frac{1}{8}$ -in. bakelite. The end holes in Fig. 2 are for mounting them on the chassis. Small pin jacks are fitted in the $\frac{3}{16}$ -in. holes in Fig. 3 and also in Fig. 4. The $\frac{3}{8}$ -in. hole in Fig. 3 is for a closed-circuit jack used for breaking into the plate circuit of the pentode output tubes. The bracket, Fig. 5, fastens the 2-mfd. condenser to the underside of the chassis. Two brackets are used for mounting the resistors as in Fig. 6. Fig. 7 shows how these brackets are fastened to the resistors with two $4\frac{1}{2}$ -in. lengths of 6-32 threaded rod with a nut at each end. The sliding clips will, of course, be placed on the resistors before they are mounted.

The top of the layout is shown in Fig. 8, and the underside view in Fig. 9. These diagrams will inform the builder just where the various parts are mounted. It will be noted that the power-transformer terminals extend through the slots

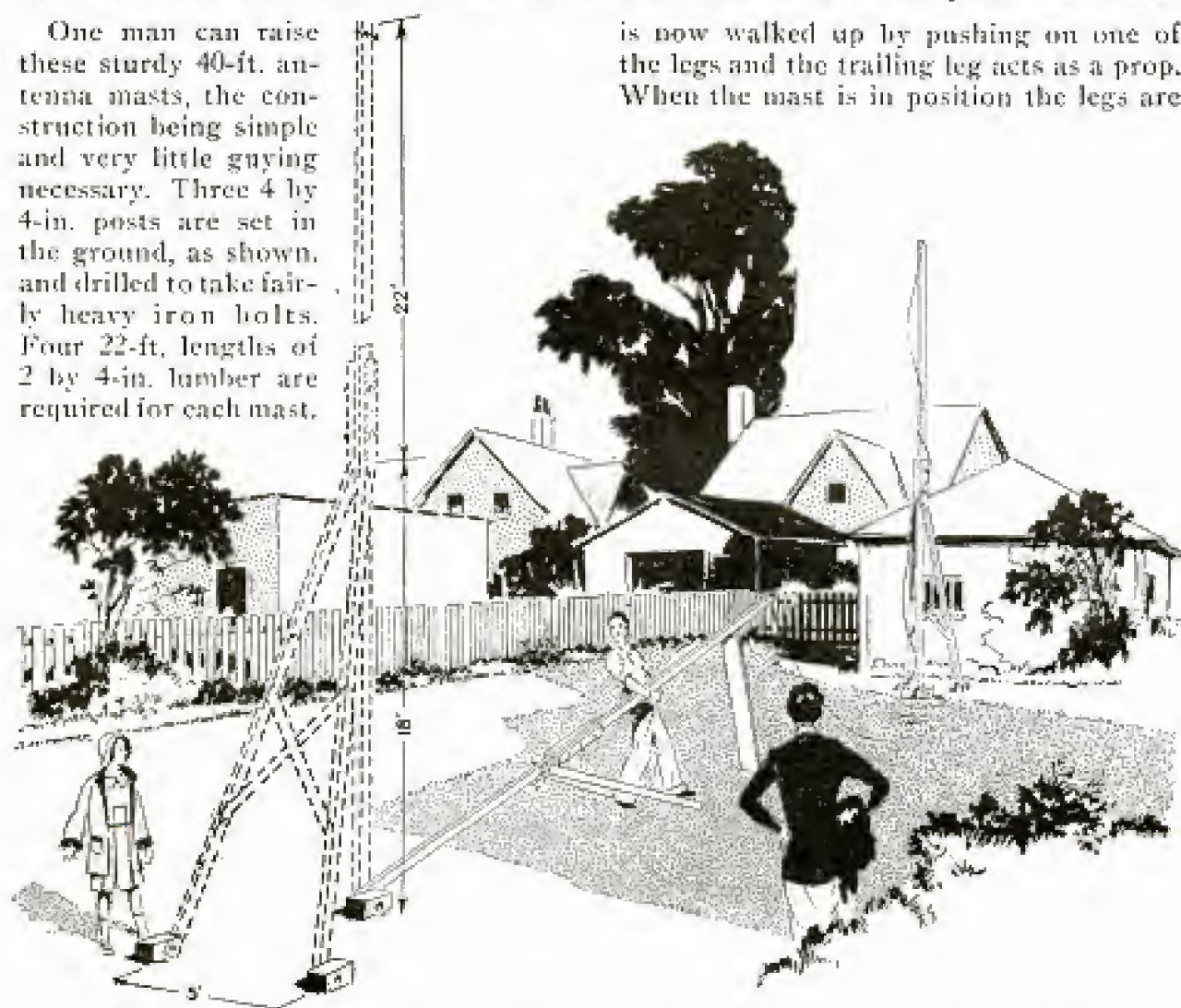


cut in the chassis,
as indicated in the
lower diagram.

When mounting the wafer-type tube sockets, the positions given on the layout diagram should be followed. The grid terminal on the five-prong sockets is always the one that is slightly isolated from the others. Several of the mounting screws are used to hold a part on top as well as underneath, and it will also be necessary to counter-sink a few holes where the screw heads come under a part. Lock washers and soldering lugs will insure good mechanical and electrical connections.

One-Man Antenna Masts Are Easily Erected

One man can raise these sturdy 40-ft. antenna masts, the construction being simple and very little guying necessary. Three 4 by 4-in. posts are set in the ground, as shown, and drilled to take fairly heavy iron bolts. Four 22-ft. lengths of 2 by 4-in. lumber are required for each mast.



is now walked up by pushing on one of the legs and the trailing leg acts as a prop. When the mast is in position the legs are

The material must be free from weakening knots. Two of these lengths are lapped and bolted for the upright member. The remaining lengths are held loosely by a single bolt directly below the lapped joint. This bolt forms a hinge as the mast is raised. The lower ends are now drilled to take the bolts in the base posts. The mast is loosely bolted to the forward post and both of the side members, or legs, are swung forward toward the top of the mast. When completed, the tip of the mast is raised four or five feet and held with a prop. A pulley is fastened to the end and the rope for the antenna wire threaded through it. This is a very good time to give the mast a coat of paint that will preserve the wood. In localities where high winds are prevalent three or four guy wires should be fastened near the top of the mast before it is raised. The mast

is now walked up by pushing on one of the legs and the trailing leg acts as a prop. When the mast is in position the legs are bolted in place and the cross braces added as shown.

Loose Laminations Cause Hum

A particularly baffling case of hum in a radio receiver was finally traced to vibrations caused by loose laminations in the power transformer. These vibrations were transmitted mechanically to the chassis of the set and thus to the detector and amplifier tubes, causing a noticeable hum in the speaker output. The trouble was easily corrected by tightening transformer core-clamping screws. If these are not accessible, cushioned tube sockets will usually eliminate trouble of this description.

Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; material lists are always available without charge.



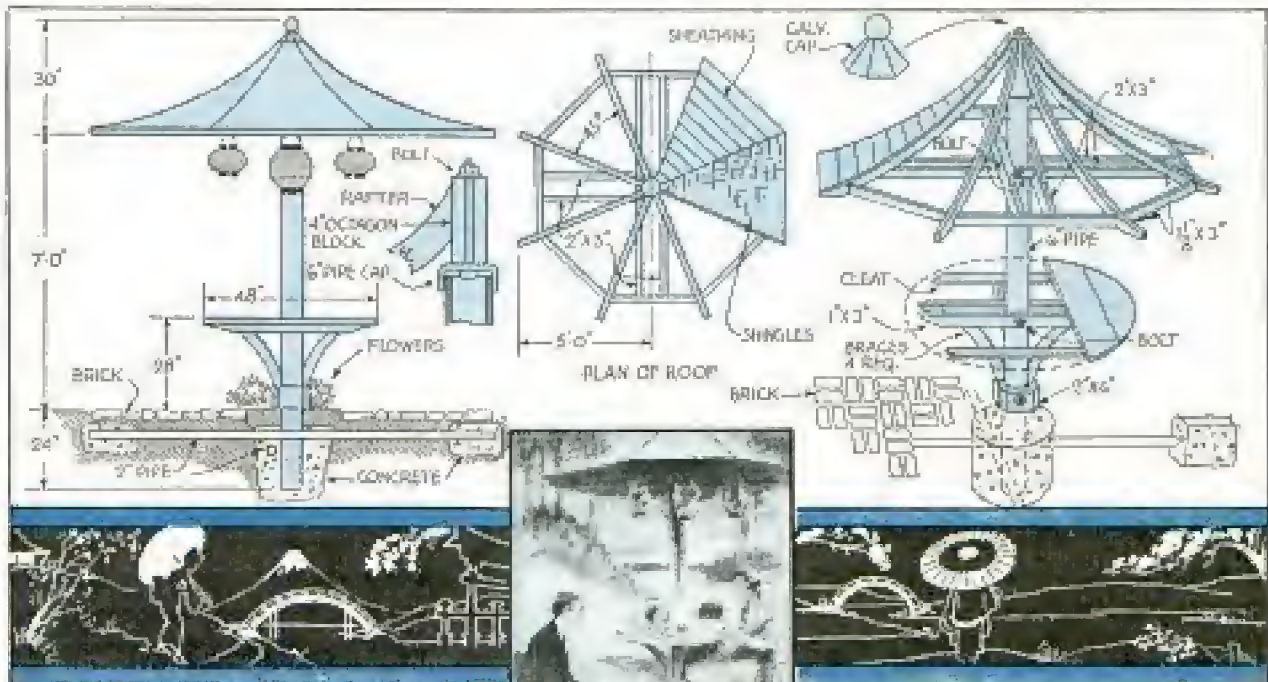
Make and Play the NEW MARBLE-BOARD GAMES

MARBLE boards, that were known to all the boys of a few years ago, have again come to the front and, in slightly different form, have become highly popular as a source of amusement for older persons as well as for the children. In this article, two variations are given in Figs. 1 and 3, the former being the simpler arrangement, while the latter has a coil-spring shooter and a marble return, and is glass-covered.

To make the one shown in Fig. 1, cut a base of plywood or standard $\frac{3}{4}$ -in. stock, and screw or nail on sides of $\frac{3}{8}$ -in. material to project 1 in. above the playing surface. The $\frac{3}{8}$ by 1-in. curved strip, around which the ball races, can be bent without steaming, the



Shingled Parasol Shades the Lawn Tea Table

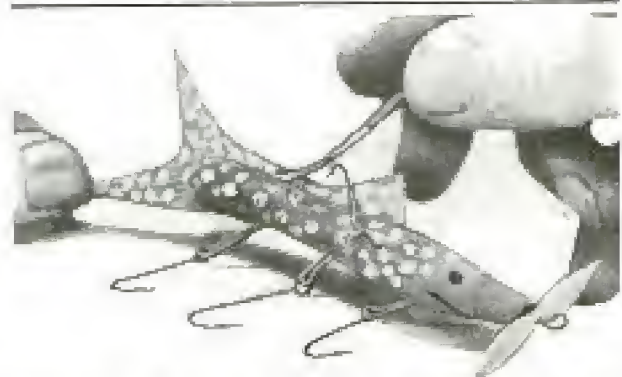


Here is an attractive lawn parasol that provides shade for several persons and will not fade in any weather nor tear loose in a storm. Bury two 10-ft. lengths of 2-in. pipe at right angles to each other about 1 ft. underground, and set a 6-in. pipe or post upright in the middle, after having located the bolt holes for supports of table and canopy. Pour concrete around the hub at the base and also at the ends of the crossed pipes. This makes rigid anchorage which will not loosen no matter how wet the ground may be. Lengths of 2 by 3-in. stock are set in pairs, at right angles, to support the canopy frame, and on top of the 6-in. pipe is placed an octagon block of wood bolted to a cap. This forms the support for the upper ends of the curved rafters. Sheathing should be light material, say, $\frac{1}{2}$ -in. matched pine, in narrow widths so that it will follow the curves of the rafters neatly. Over this, lay composition shingles spaced unevenly. The table is built as shown, supported by cross-pieces, cleats and curved braces. Make the diameter at least 48 in. and screw the boards to the cleats, etc., from the underside. Take pains to level the table properly. Around the base of the post, fill with well fertilized soil or leaf mold and set out such shade-loving plants as pansies, and the like. The remainder of the area

coming directly under the parasol top should be covered with bricks or flagstones, for even the toughest growth of grass will soon wear away under constant trampling. Besides, the brick or flagstone is fairly dry in damp weather, so that the chair legs will not sink into the ground.

Fish Lures Made from Clothespins

Attractive fish lures can be made from clothespins. The tail and the back fin are cut from brass shim stock and are clamped between the prongs of the pin with small brads, while small cotter keys are driven tightly into the wood to hold the hooks, nose spinner and line swivel. Bright-colored lacquer is used for the painting.



Fitted with Tail and Fins, Common Clothespins Make Attractive Fish Lures



Ordinary Hair Comb Can Be Used to Strip Small Fruit from Stems Quickly

Comb Strips Small Fruit from Stem

For stripping small fruit, such as elderberries, currants, etc., from their stems, an ordinary hair comb has been found effective. By using this method, berries can be gathered in a fraction of the time otherwise required and without as much risk of damaging them.

Clogged Breather Holes Cause Storage-Battery Trouble

Screw caps on the cells of a storage battery have a small hole drilled through them to allow ventilation and the escape of gases caused by charging. If these holes become clogged, the battery uses an excessive amount of water, sweats through the walls of the case, and a white deposit appears on the battery and brackets. The caps should be inspected periodically, and the small holes cleaned out when necessary.—C. B. Dean, Alhambra, Calif.

Holders for Fresh Paint Signs

Pin card holders make good fasteners for signs on freshly painted surfaces.



Bend the pins at right angles, and after clipping the loops over the sign, the pins can be stuck into a new-painted surface without marring it.

Drawing with a Perspectograph

Here's a "magic" drawing box that anyone can make and use for copying landscapes or any other brightly illuminated scenery. The user merely points the lens of this reflecting device toward the scenery he wishes to draw, and the mirror inside, set at a 45° angle, reflects the image through the glass top and against a strip of tracing paper, on which the artist traces the reflection. When finished with one sketch, he pulls it out and tears it from the roll. A hinged hood is needed to shade the paper, as too much light from above will prevent the user from seeing the image. The box has two slides; one permits replacement of the roll of paper and the other gives access to a separate compartment in which finished sketches are stored. The size of such a sketching box can, of course, be varied to suit the user. The inside should be painted a dull black to minimize reflection. Any good condensing lens obtainable from an old reading glass, magic lantern or post-card projector, can be used. It is mounted in the side of the box, as shown in the right-hand detail on the opposite page.

Bench Stop from Safety-Razor Guard

For use with light work, the guard of an old safety razor will form a bench stop by screwing it to the bench as shown. If the stop is placed in the center of the



bench, the work can be held in vertical position on either side.

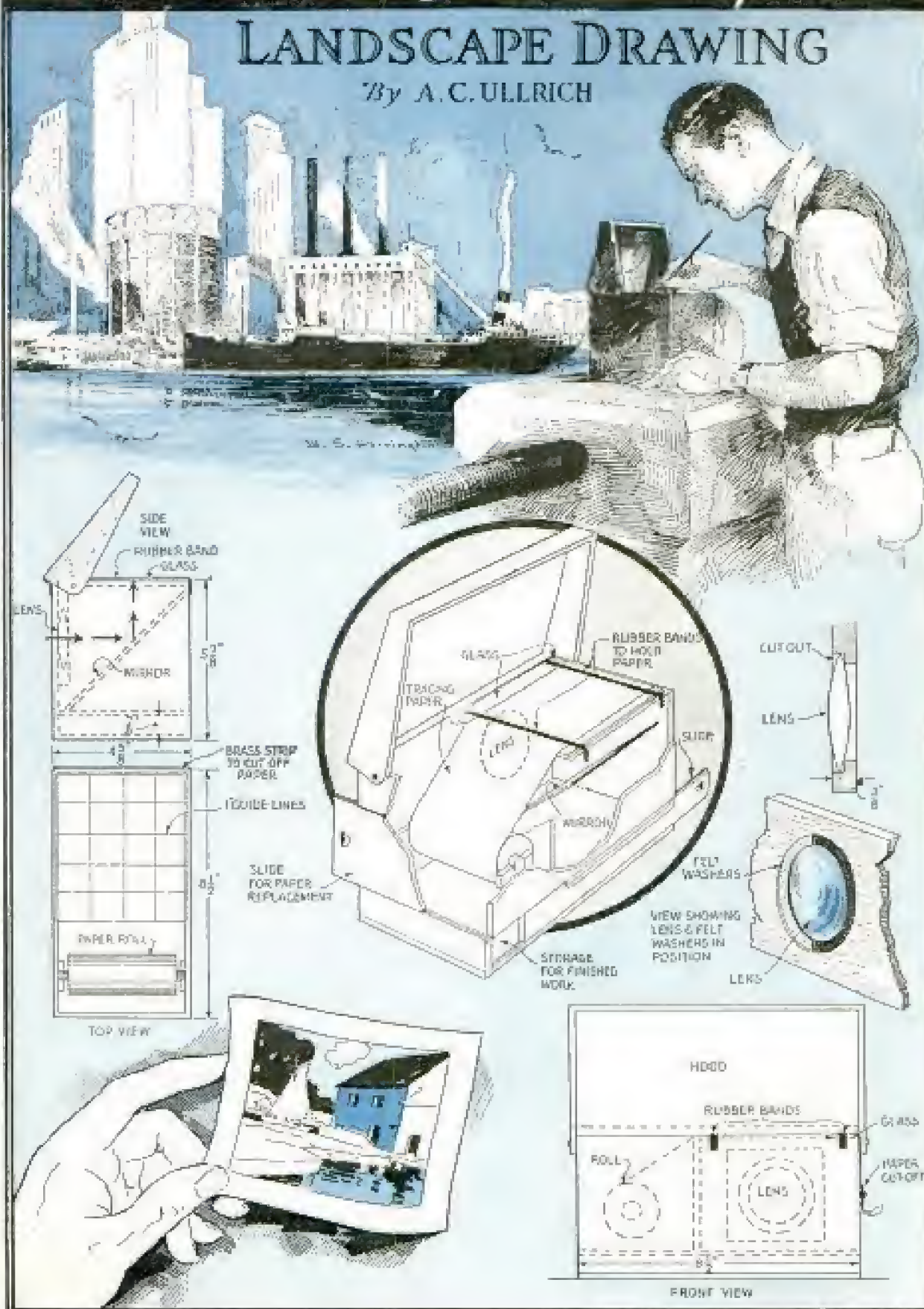
Talcum Powder Cures Sticky Cards

Playing cards, after being used for some time, often have a tendency to stick together, which makes shuffling and dealing difficult. This trouble can be remedied by sifting a small quantity of talcum powder between the cards and shuffling them until the powder has been evenly distributed over the surface of each card in the deck.

"Perspectograph" *simplifies*

LANDSCAPE DRAWING

By A.C. ULLRICH





Sharp Rotating Disk on Homemade Lawn-Edging Tool Cuts Sod Quickly

Lawn-Edging Tool Made from Sharp Disk and Skate Wheel

Attached to the end of a 5-ft. wooden handle, as shown in the detail, a sharp disk attached to a skate wheel, which serves as a bearing, has been successfully used as a lawn-edging tool. A length of rather heavy flat iron is bolted to the end of the handle and drilled for another bolt, which serves as the axle for the disk. An old circular saw is ground to a sharp edge and used for the cutting disk.—E. Dallner, Ozone Pk., N. Y.

Gluing Overlay Work

When doing overlay work, it is not necessary to clamp the pieces in position after gluing them, if you apply the glue to the bottom of the piece

and then slide it back and forth until it gets in the desired position. In this way, all of the air is forced out of the glue, and it will adhere just as well as if the pieces were clamped. This enables you to go on with your work and makes neat joints.

Periodical Cleaning of Camera Insures Better Operation

Cleaning your camera at regular intervals, especially after a dusty trip, will insure perfect operation and better pictures when it is again used. To do this, slowly open the bellows to the full extent and remove the lens and shutter assembly. Then, with a vacuum cleaner, remove the dust from the inside and outside of the bellows, especially at the corners. If the bellows do not open freely, rub the guides, slides and all parts that bind, with a soft black lead pencil. The coating of lead thus applied will act as a lubricant and is much cleaner and safer than oil, which should not be used on a camera. Replace

the assembly, remove the lenses, one at a time, and polish them carefully with a clean linen handkerchief. Now take the camera to a dark room and remove the back. Place a small flashlight in the bellows and inspect it for holes. If any are detected, they can be repaired by sticking black gummed tape over the hole inside of the bellows and cementing thin black leather over the outside with rubber or leather cement. In this way, the tape inside of the bellows will act as a reinforcement to the patch on the outside.—G. T. Richards, Arkansas City, Kans.

\$1,000 in Cash For Best Models of Whittling

1st prize.....	\$250
2nd prize.....	\$100
3rd prize.....	\$75
4th prize.....	\$50
5th prize.....	\$25

BESIDES this, there will be twenty-five \$10, fifty \$5 prizes, and one thousand high-grade jackknives.

Rules for "Knife-Craft" Contest

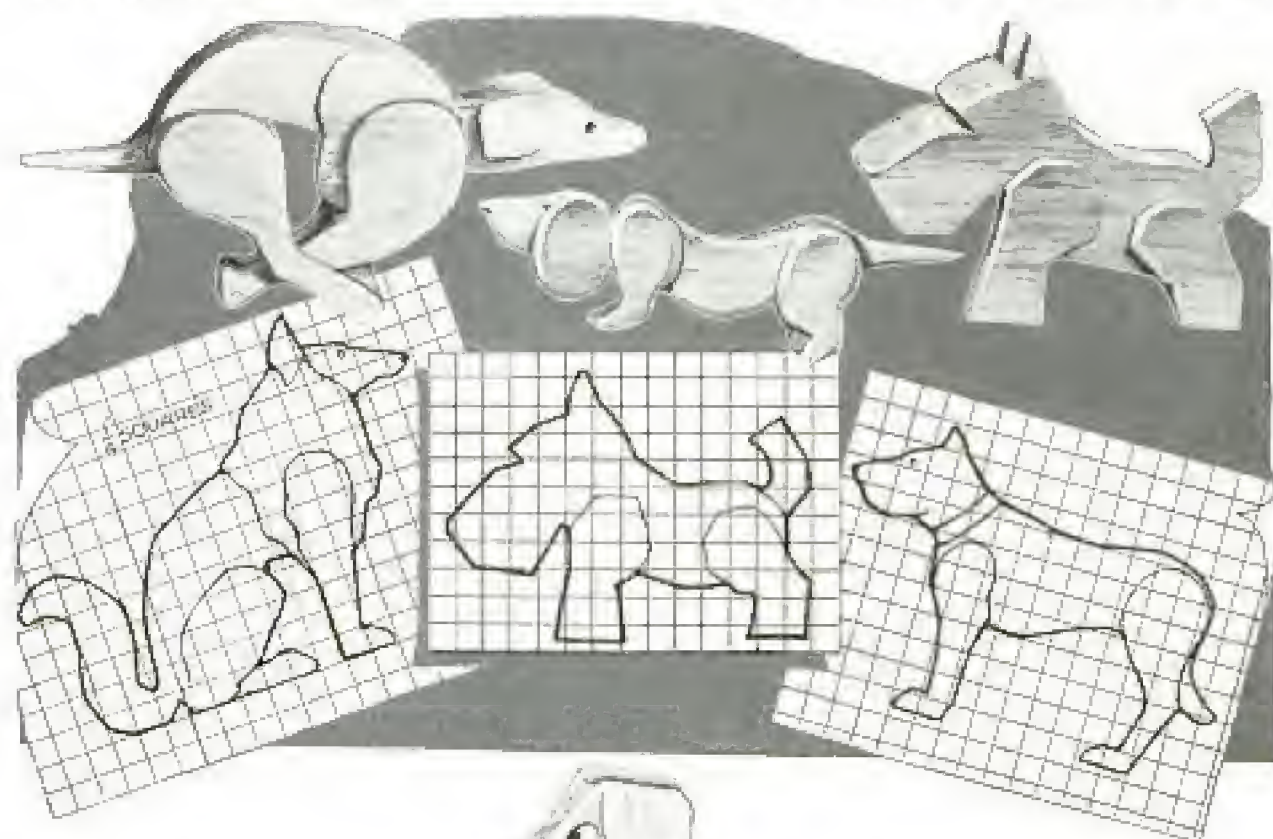
Anyone except employees of Popular Mechanics and members of their families can enter this contest, which closes July 1st, 1932. Awards will be made by a competent board of judges and in the event of a tie for any prize offered, a prize identical in all respects with that tied for will be awarded to each tying contestant.

1. One or more entries may be made. Models must be entirely of wood, and cut with no other tools than a jackknife.
2. No adhesives may be used.
3. Carvings submitted must not be painted, silvered or gilded, and will remain the property of Popular Mechanics after the contest closes.

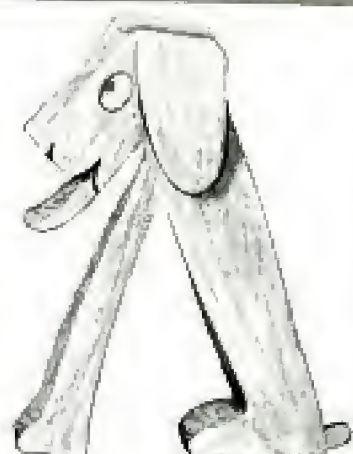
All models must be shipped, prepaid, in suitable packages to avoid breakage. Be sure to affix tag giving your name and address on the outside wrapper of the package.

Address "Knife-Craft" Editor
POPULAR MECHANICS MAGAZINE
200 E. Ontario St. Chicago, Ill.

Whittled Pups to Decorate Table and Desk



Any straight-grained piece of wood, either hard or soft, can be used to carve out little pups to place on your bric-a-brac shelf, table or desk. Normally, the grain should run the length of the body, and this should be carefully taken into account when tracing the layouts on the wood with carbon paper. As the grain runs across the legs, they should be cut last and with care to avoid breakage. You



can use a scrollsaw to cut out the design roughly and then finish the details by carving with a sharp pocketknife. Bright-colored enamel or lacquer greatly adds to the finished appearance of these novelties. Besides the examples shown here, many other variations can be obtained by copying pictures of animals

from magazines and newspapers.—E. J. Tangerman, Bayside, N. Y.

Model-Boat Stuffing Boxes Made from Tubing Connectors

With slight alterations, copper-tubing connectors can be used for stuffing boxes around the propeller shaft in motor boats. If the shaft uses a piece of steel tubing for a bearing, the threaded end of the connector is drilled out to fit the tube and is soldered to it. The hole through the center portion of the fitting is drilled out for clearance on the shaft and to allow suitable space for the packing material. A small wire should be twisted around the

nut, fastening the free end to some part of the boat so that the tension on the stuffing material may be adjusted to prevent leaks, and at the same time provide reasonable freedom for the shaft. If the steel tube used is not quite loose enough on the shaft, it can be ground out with fine valve-grinding compound, using a rod the same size as the propeller shaft. —J. D. Brubaker, Evanston, Ill.

☛ Bugs and other foreign matter that spot the windshield are easily removed with a 10-cent "chore-ball."

Illuminated Crepe-Paper Signs



Translucent Lettering of Crepe Paper on Cardboard Signs Is Effective When Illuminated from Rear

Attractive signs can be made by cutting letters or figures in a piece of black or colored cardboard and gluing colored crepe paper over the openings. They are particularly attractive when hung where light shines through them from behind. If desired, a small box containing a lamp and reflector, to provide illumination, can be placed directly behind, or it may be fastened to, the sign. This method is a good one for showing up your house number at night, a 5-volt lamp furnishing sufficient light.

Simple Tests to Determine Quality of Mohair

Inferior grades of mohair are easily distinguished from the better grades by a few simple tests that can be made in the store. All mohair velvet is woven on a cotton back called warp. The inferior grades have a coarse warp, the threads are larger, and there are fewer of them to the square inch. The appearance of the back is generally coarse and rough as compared with the better grades. Cheaper grades of mohair also have fewer fibers to the square inch than the better varieties. If the cotton warp shows through from the surface, except when designed to give a contrasting color effect, or if the fibers can

be pushed aside and the warp revealed easily, the fabric is likely to be one of inferior grade. Mohair has a characteristic feel. The fibers should be smooth, resilient and springy to the touch, and they should return to their erect position when the pressure is removed. The cheaper grades can sometimes be distinguished from the better qualities by the amount of "kemp" or dead hair they contain. Kemp is easily identified because it does not take the dye as does the rest of the mohair and lacks the luster. Close examination of the surface of the better grades will show practically none of these dead hairs. Another test is to hold the sample firmly stretched between the thumbs and middle fingers and to push against the pile fibers with the forefingers. After pushing a few times on the cheap grades, the fibers will be seen coming through the warp. Pure mohair fabric can easily be distinguished by its characteristic sheen. Mixtures do not have this luster, which is almost as bright as the sheen of silk when the sample is held so that the light strikes the tops of the fibers.

Rack on Car Door Holds Umbrella

Slipped into a leather pocket attached to the car door, your umbrella will be out of the way, yet at hand when needed. The pocket should be placed at the lower corner near the hinged side of the door, and a small strap is provided above it to hold the handle.



Umbrella Held by Pocket and Strap on Car Door Is Always at Hand When Needed

BOOKSHELVES *improve the* HOME

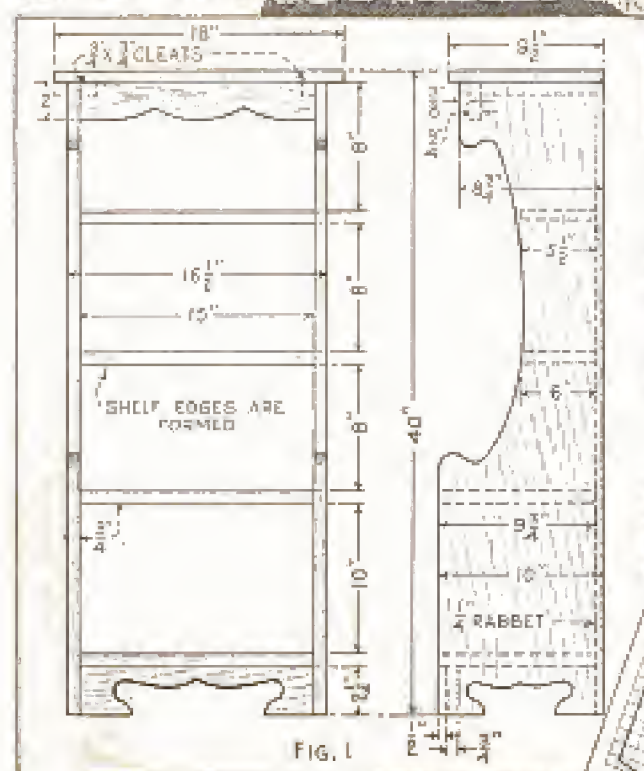


FIG. 1

By R. O. BUCK

Lane Technical High School
Chicago

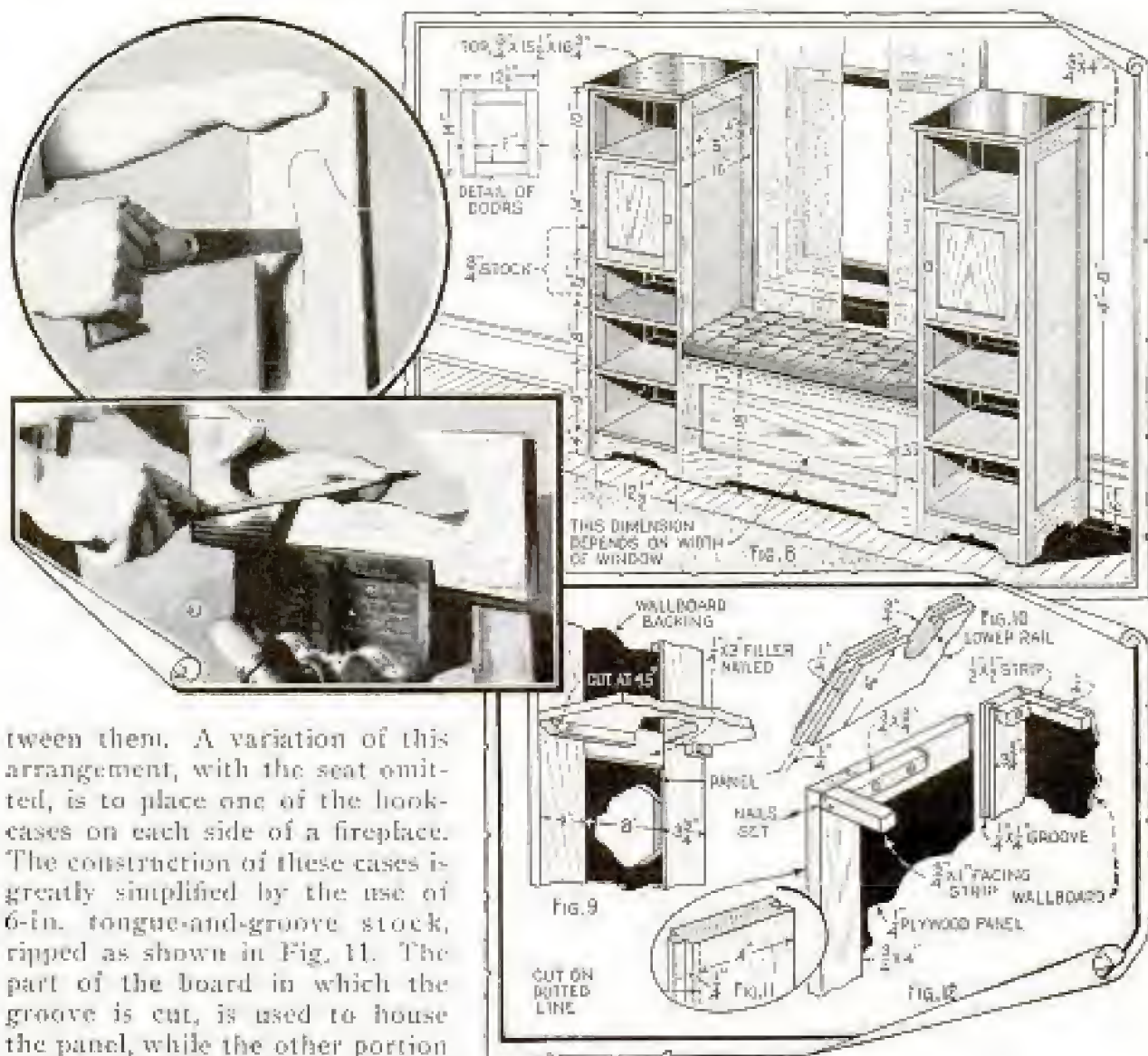
ATTRACTIVE and serviceable bookshelves for the home can be made of clear yellow pine and finished with either stain and wax or paint. The shelf shown in Figs. 1 to 5 is an early-American design, gracefully and sturdily built and simple in construction. Three-fourth-inch stock is used for the sides and shelves, while the back may be made of either $\frac{1}{4}$ -in. plywood or $\frac{3}{4}$ -in. matched ceiling stock. In both cases, the back is rabbeted to the sides so that the edges come flush. Patterns for the aprons, shelf edges and ends are given in Figs. 2, 3, 4 and 5. The aprons are simply glued and nailed into place, $\frac{3}{8}$ in. from the front edge. The front edges of the shelves are slightly curved. The bulges of the curve are in line with the front edges of the sidepieces, but the ends are set back $\frac{3}{8}$ in. Glue and long finishing nails, or slender screws, are used



to fasten the shelves, after which the nails or screws are driven below the surface and the holes filled with a mixture of fine pine sawdust and liquid glue. A dark-oak or walnut stain is applied over the entire case, and is followed by several coats of wax. However, attractive finishes and colors, to match other furniture in the room, may be used. Either

finish requires a well sanded surface in order to make a good-looking job. Fig. 6 shows the cutting of the bottom aprons and Fig. 7 indicates the process of smoothing the curved edges with a file.

Twin bookcases of the kind shown in Fig. 8 can be arranged to go on either side of the window with a cushion seat be-



tween them. A variation of this arrangement, with the seat omitted, is to place one of the book-cases on each side of a fireplace. The construction of these cases is greatly simplified by the use of 6-in. tongue-and-groove stock, ripped as shown in Fig. 11. The part of the board in which the groove is cut, is used to house the panel, while the other portion holds the shelf cleats, etc. Tenons are cut in the bottom and top rails as in Fig. 10. Of course, the tenons are too short to make a tight joint, but they serve to hold the pieces in line. The joints of the entire side assembly are reinforced by shelf cleats at frequent intervals, to obtain rigidity. Fig. 12 shows the general framing plan of the top with one of the cleats screwed and glued in position. Note that the top of the case is omitted in this detail for the sake of clarity. The side panels should be framed up first and the $\frac{1}{4}$ -in. plywood inserted in the grooves. The use of glue on the panels is not advisable, as the grooves provide allowance for contraction and expansion, and for that reason the panel should fit rather loosely. Wallboard is tacked in a $\frac{1}{4}$ by $\frac{1}{4}$ -in. rabbet along the inside edge of the two rear sides and to the rear edge of the shelves to increase rigidity. Fig. 9 shows how the

shelf cleats are cut off at a 45° angle so that they will not be noticeable from the front.

The cabinets are optional, the construction of the panel doors being similar to that of the side panels except that no cleats are used to reinforce the joints. For the sake of symmetry the doors are hinged on opposite sides.

The construction of the seat is also simple. Only a front panel is needed, as the sides and back consist of cleats screwed across the back of the panel and to the side of the cases, to support a hinged lid, which is set $\frac{3}{4}$ in. below the top edge of the front to keep the cushion in place. The lid itself is made of tongue-and-groove stock, held together with cleats on the underside, and is hinged at the rear edge. A false bottom keeps the contents off the floor.

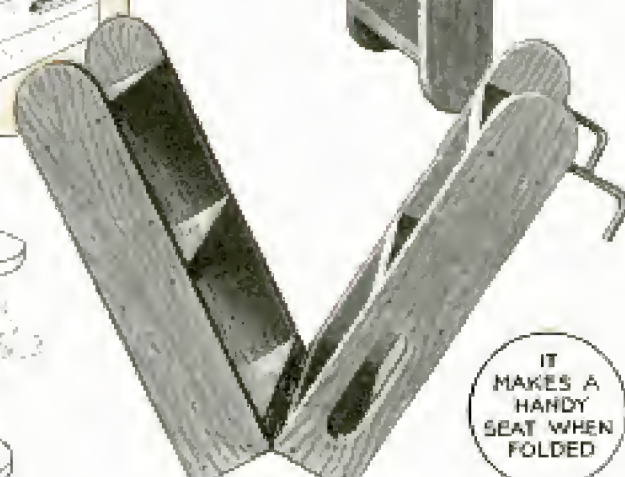
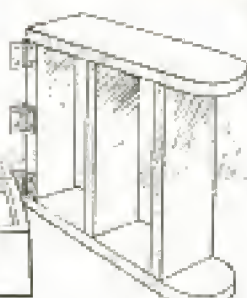
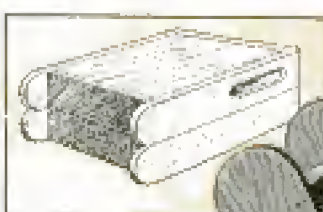
A Handy Boarding Ladder for Small Boats



Opened up, this handy bit of marine equipment makes an excellent boarding ladder for swimmers and, when closed, can be used as an extra seat. The construction is fairly simple, being nothing more than a short ladder with 10-in. steps recessed into the sidepieces. When in use, two $\frac{3}{16}$ -in. carriage bolts serve to hold the ladder securely in place, the turned-down ends of the bolts being fitted into sockets provided in the covering board. To make the ladder suitable for use as a seat, the heads of the bolts must be filed flat, as shown in the circular detail, so that they may be slipped into a mortise in the bottom section. Another mortise is cut for the turned-down end of each bolt so that the shank will come flush when the ladder is closed. The seat portion is made by rabbeting all around the back of the upper portion, as shown, and setting in a panel of $\frac{3}{8}$ -in. plywood. This ladder will fit any 16 to 22-ft. runabout or cruiser, but can be made larger or smaller to suit other craft. Rubber treads may be tacked to the steps. Finish with paint, or stain and spar varnish.



THREE
HINGES HOLD
THE SECTIONS
TOGETHER.



IT
MAKES A
HANDY
SEAT WHEN
FOLDED

A Parachute Jumper for Your Kite



Parachute Jumper for Kite Flying Is Made from Silk Cloth and Clothespin

Traveling up the string and then leaving the kite in realistic fashion, this toy parachute jumper provides much amusement. Drive a brad into the top of a clothespin and bend it to form a hook, as shown. Then get two 2-in. lengths of No. 20-gauge wire and bend an eye at one end of each, to take a tack with which the pieces are fastened to opposite sides of the pin, about $\frac{1}{2}$ in. from the top. Tie 1-ft. lengths of string to the edges of an octagon-shaped piece of silk cloth and fasten the remaining ends of the string to the wire arms on the pin. When flying your kite, hook the jumper over the kite string so that the wind will pull it up toward the kite. When you want the jumper to leave the string, jerk the string quickly.

Paste Useful to Clean Carpets

Carpets and rugs may be cleaned by scrubbing them with a brush using pure castile or equally good soapsuds. The rug should be scrubbed and allowed to dry on the floor so that the stiff sizing will not be

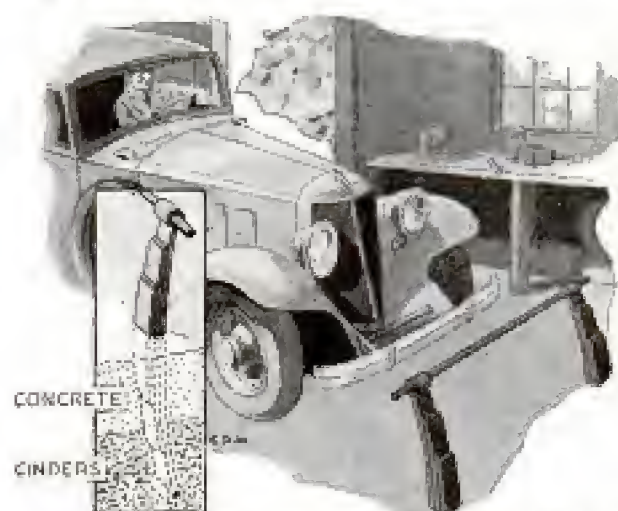
affected, and no more water should be used than is necessary. If the color in the rug is fast, 2 lb. of sodium carbonate, 1 lb. of fuller's earth and 4 oz. of turpentine can be mixed with sufficient soft soap to make a paste. This compound will give good results on grease and old spots.

Stereotype Metal Makes Good Casting Molds

Amateurs who have a limited supply of equipment will find stereotype metal good for making casting molds, as it has a low melting temperature, which is easily reached with ordinary heating methods. Wooden patterns can be used without burning, if the metal is not cast in too large quantities. Care should be taken to avoid getting water into the molten metal, which would cause it to splatter. The correct casting temperature has been reached when a piece of paper inserted into the molten mass turns a rich brown. Stereotype metal is fairly strong and will not crack under sharp blows. It can usually be obtained from small newspaper offices.

Car-Spring Bumper Protects End of Garage

Two semi-elliptic car springs, set in concrete near the end of the garage, provide a flexible bumper and prevent the car from being driven against the wall. An iron rod is inserted through the holes in the ends of the springs to make the bumper more effective. The springs should be no higher than the bumper.



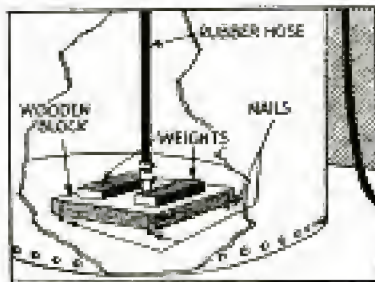
Two Springs Set in Concrete Floor Protect both Auto and Garage Wall from Being Damaged

How to Produce Steady Boiling

Steady boiling of liquids can be assured by immersing a bulb of glass or metal with a small hole in one end in the liquid, the hole being placed near the bottom of the container. To make such a bulb, heat a glass test tube near the center and draw it out until the two parts separate. Break the fine tip from the closed portion so that a small opening is left, and fire-polish the end by heating, being careful not to seal the hole. Another method is to make a small bottle out of copper or other metal by soldering the ends of a piece of tubing shut and drilling a needle-size opening in it. Only one bulb for each container is needed. The increase in temperature forces the air in the bulb out through the small opening where it forms the nucleus for bubbles which rise to the surface. A small bulb will keep the liquid boiling steadily for an indefinite length of time, providing too much heat is not applied. The bulbs should be removed as soon as the heat is shut off so they will not take up any of the liquid when cooling.

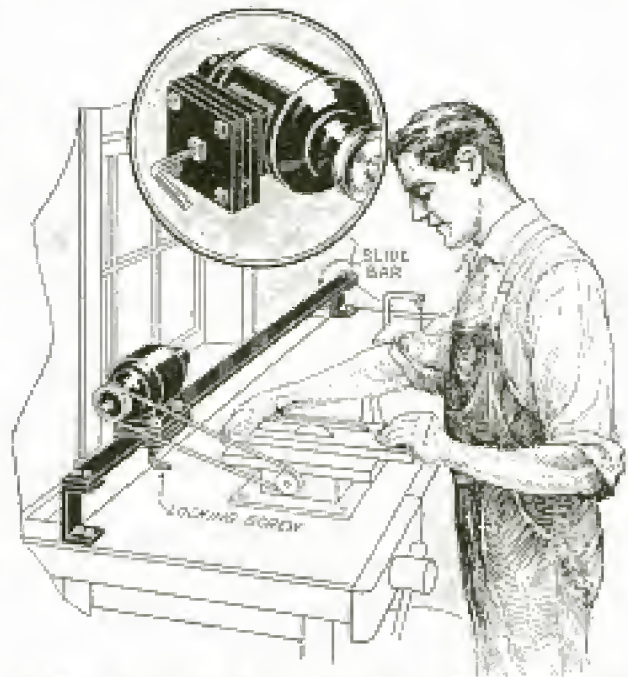
Weighted Block Keeps Siphon on Bottom of Container

A siphon hose, attached to a short pipe, which is inserted through a hole drilled in the center of a weighted block, enables large tanks to be drained without attention. A nail is driven into each corner of the board, the heads of which extend down a fraction of an inch to support it and provide space for entrance of the liquid.



Pad on Mower Wheel Protects Trees

Most of the damage done to trees or shrubbery on the lawn is caused by a lawn mower, when the user inadvertently strikes them with the outside of the hub. To eliminate this, wire a pad on the outside of each hub. Sponge rubber has been found especially suitable for this purpose as it is resilient and easily handled.



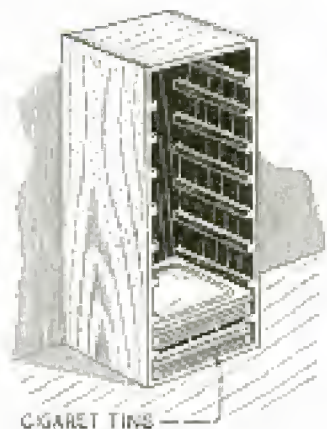
Here's a Simple Method of Using One Motor to Drive a Number of Home-Workshop Machines

Motor Slides along Support Mounted on Workbench

For driving several small tools on your workbench with one motor, a metal slide bar of $\frac{1}{2}$ by $2\frac{1}{2}$ -in. stock, mounted lengthwise on the bench, makes a convenient base for the motor, which slides along the bar and can be clamped tightly at any desired point. The base of the motor is fitted with a metal plate and two guides to hold it squarely on the slide bar. A tapped hole is drilled in the center of the extra plate on the motor base, for the purpose of receiving a locking screw that clamps against the slide bar.

Cigaret Tins Hold Small Parts

Tin boxes in which cigarettes are packed make good containers for brads, nails and screws. To keep them in an orderly arrangement, it is a good idea to make a wooden rack, cleats on the inside of which hold the tins and serve as slides. Each box may be labeled with a piece of adhesive tape indicating its contents.



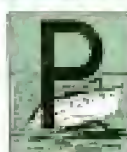
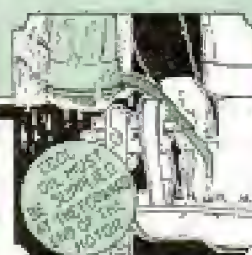
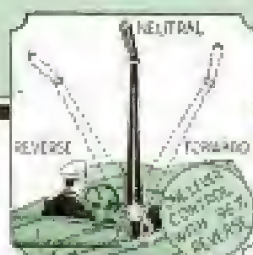
Marinette Co.
477 Packer Ave.
Green Bay, Wis.

The Barker Factory, Inc.
Norwalk Conn.

Complete Details of a

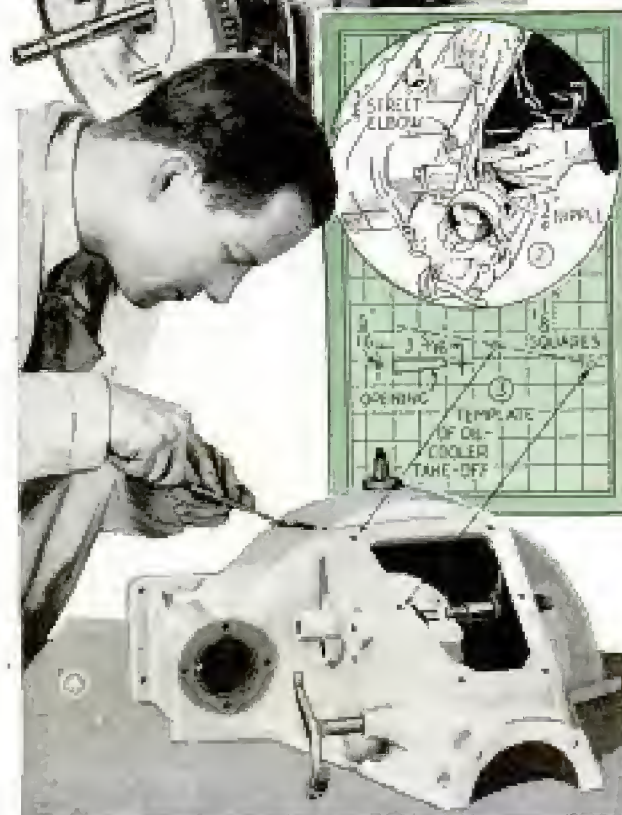
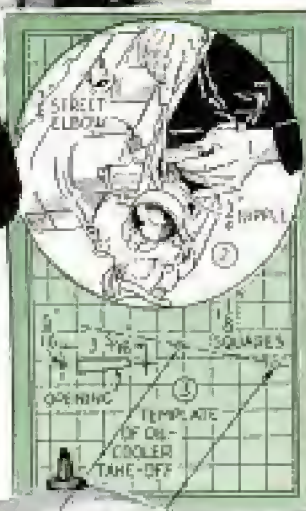
A FORD MOTOR

Motor
Adaptation
Courtesy
T. J. Badler



PROPERLY converted, the model-T Ford motor makes an excellent marine power plant for small boats, giving a speed of 18 to 22 miles per hour when installed in the average 16 to 18-ft. runabout, and comparative speeds when used with a reduction gear on work boats and light cruisers.

In order to understand the difference between the motor as used in an auto and as used in a boat, consider the five little sketches at the top of this and the next page, which picture the five major changes necessary. The first, from left to right, has to do with the transmission and control system. In a car you have a low and a high forward speed, a neutral and a low-speed reverse; on a boat you want a high-speed forward, neutral and a high-speed reverse. That's change No. 1. The second picture shows the oiling system. In a car this is a simple splash system, with only a small-diameter tube carrying the oil forward; in a boat the angle of installation and the high speed at which the motor is operated make it necessary to supply a large amount of oil to the forward cylinders. The oil must be kept cool and at full viscosity as the heat generated by the motor would quickly break down the oil and result in burned-out bearings. The third sketch covers the water system. Water must be pumped from outside the boat, circulated through the motor under pressure, and then ejected through the exhaust line. No. 4 shows a water-cooled jacket, which will prevent the exhaust manifold from becoming red-hot. No. 5 calls your attention to the thrust bearing, a necessary feature to take up the some-

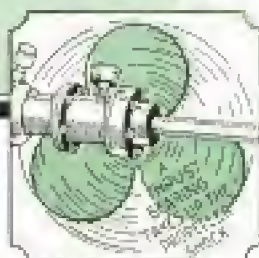


available for Rambler or Flash
see Boat Book

Practical Marine Conversion

FOR YOUR BOAT

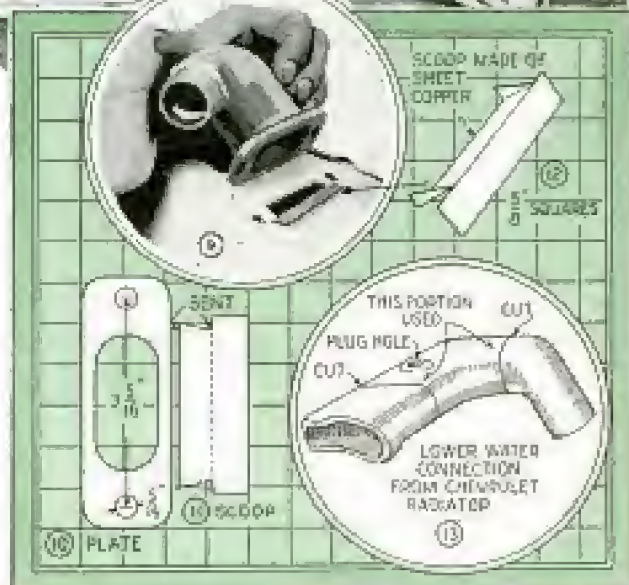
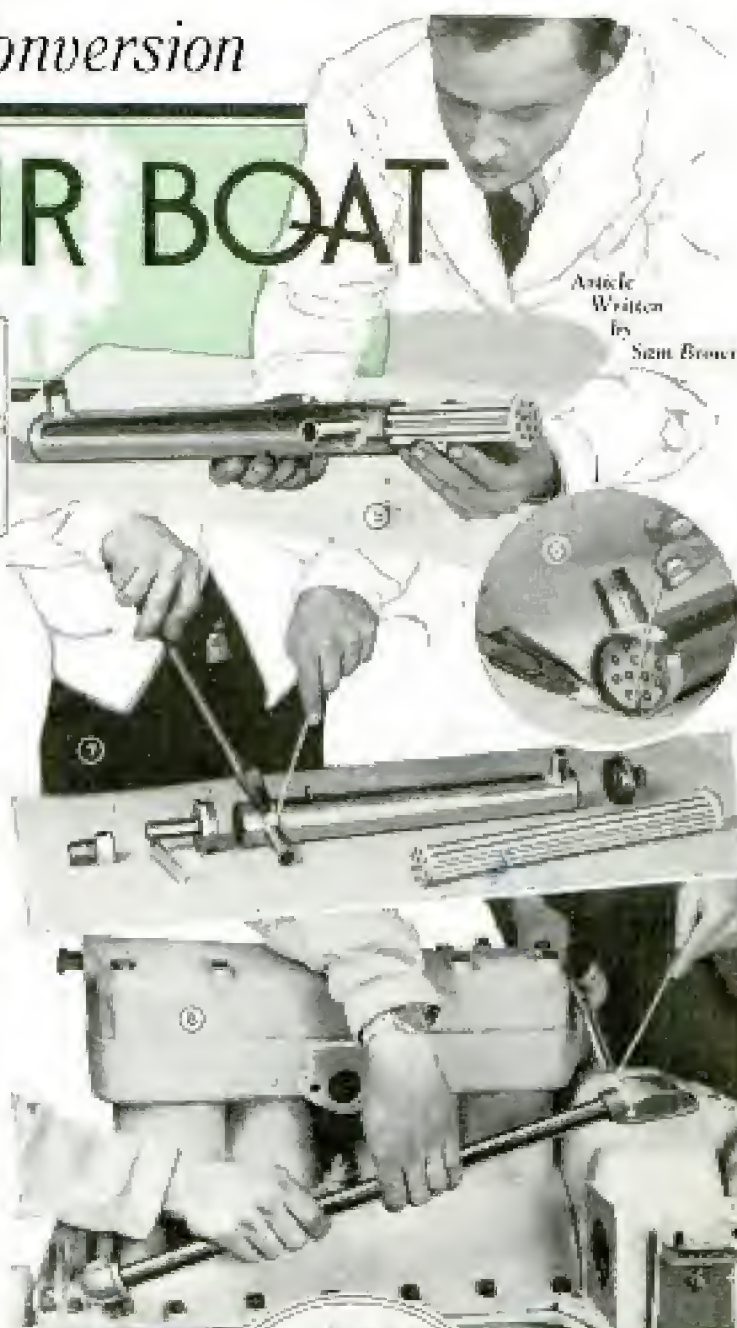
Article
Written
by
Sam Brown

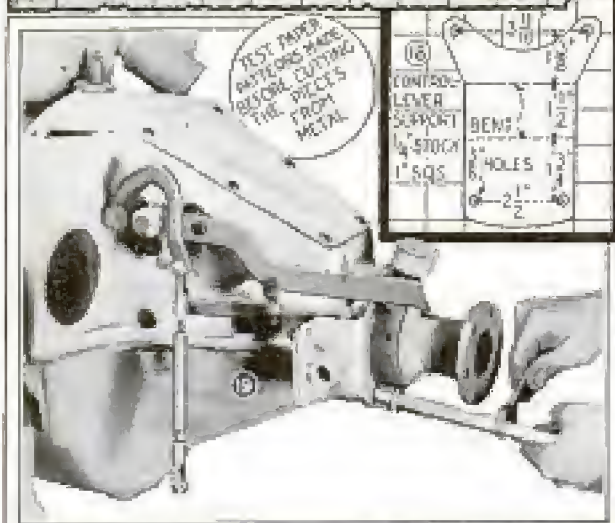
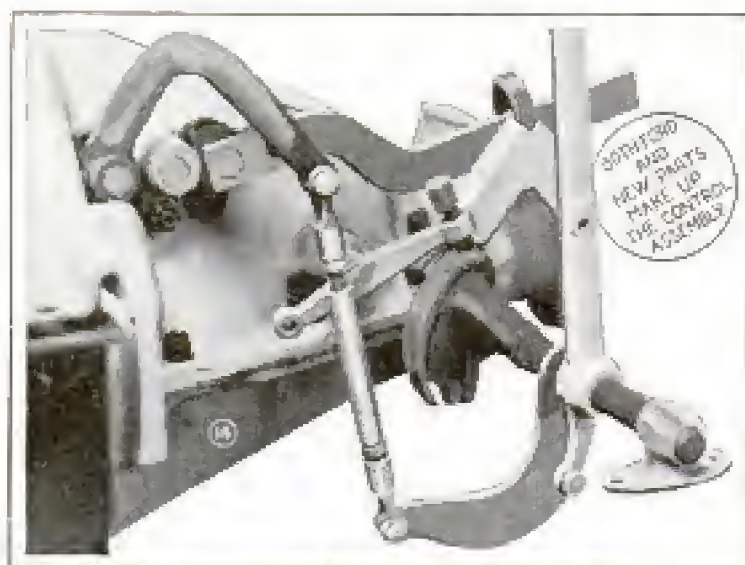


times terrific push-and-pull effect of the spinning propeller. These five changes incorporate all of the important features of the Ford conversion.

Fig. 1 shows that dirty motor you acquired for a few dollars, after the grime has been removed, new connecting rods and pistons fitted, the valves ground, the bearings taken up and the whole undergone a thorough overhauling. The transmission has not yet been reassembled, for it is at this point that you start the conversion. The slow-speed drum and the brake drum must be welded together, as shown above, and the teeth of the driven gear ground off. After grinding the gear and machining the drum surface smooth, the transmission can be reassembled.

Before the control unit can be finished, the oil cooler must be wholly or partly fitted, the changes necessary at this stage being the fitting of the inlet and outlet oil connections. First, a hole is drilled and tapped to supply the oil to the forward cylinders. This hole is centered in the slight depression in the left side of the motor base, forward. Tap this hole a little at a time, working from the underside, so that the tapering threads of a short piece of $\frac{3}{4}$ -in. brass pipe will draw up tightly in the hole at the same time it catches securely on the $\frac{3}{4}$ -in. brass street elbow, which is fitted on top, as in Fig. 2, cut off flush with a hacksaw blade after a proper fit has been obtained. For the oil



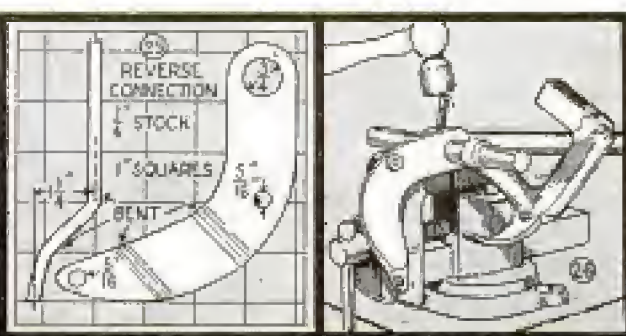
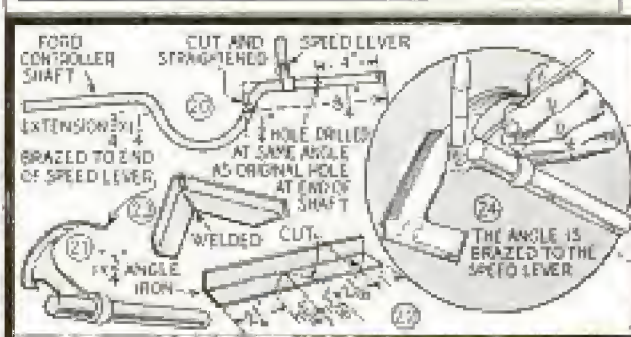


take-off, make a full-size paper template like that in Fig. 3, and, fitting this in place on the transmission-cover screw holes, drill and file smooth a hole of the same size as indicated on the pattern and shown in Fig. 4, tapping holes on either side to take $\frac{5}{16}$ -in. machine screws.

As the outlet and inlet are now completed, you may as well finish the unit which fits between these two connections. You will need a Chevrolet lower radiator connection. This is hacksawed to the proper shape by making the two cuts shown in Fig. 13. Then, the

plate shown in Fig. 10 is brazed to the wide end of the fitting. A $\frac{3}{4}$ -in. coupling is cut in two and the half-section is brazed to the smaller end. In order to get the proper angle, the fitting should be bolted into place and the half-coupling held tightly against the open end by means of a length of broomstick, which connects to a $\frac{3}{4}$ -in. elbow fitted to the street elbow at the lower end of the motor, as in Fig. 8. In this position, the coupling can be temporarily tacked after which it is removed for a complete brazing. Fig. 9 shows the finished piece. When finally screwed in place, a small copper scoop, detailed in Figs. 11 and 12, should be fitted in the opening, to better catch the oil splashed up by the flywheel.

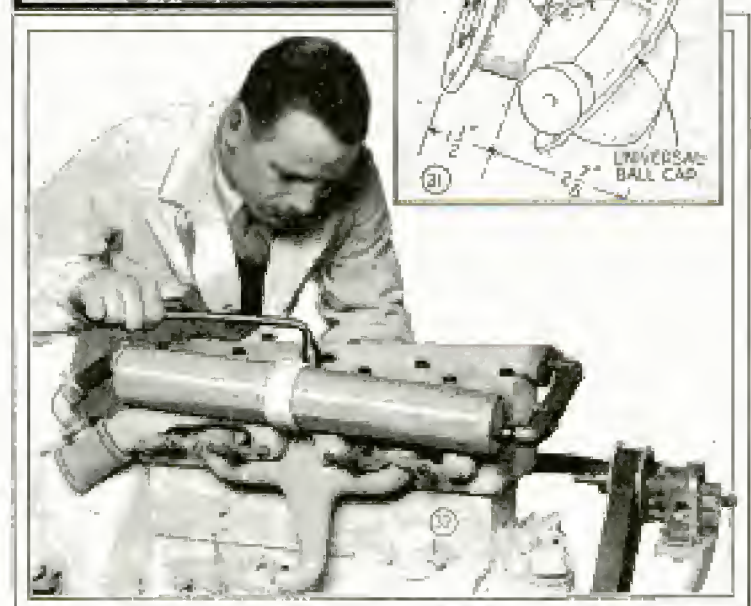
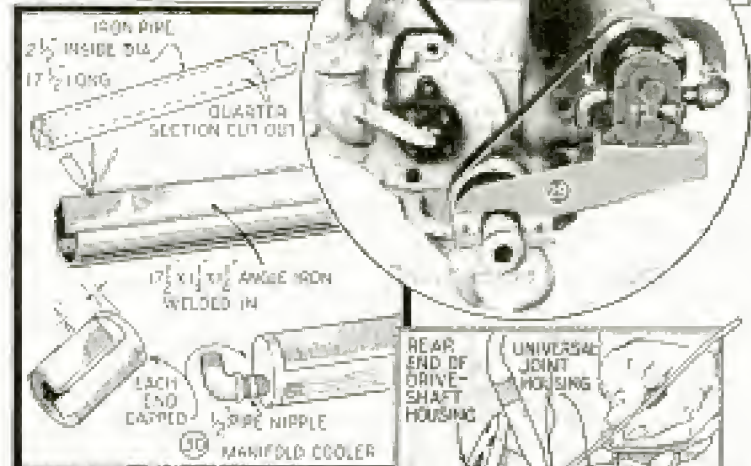
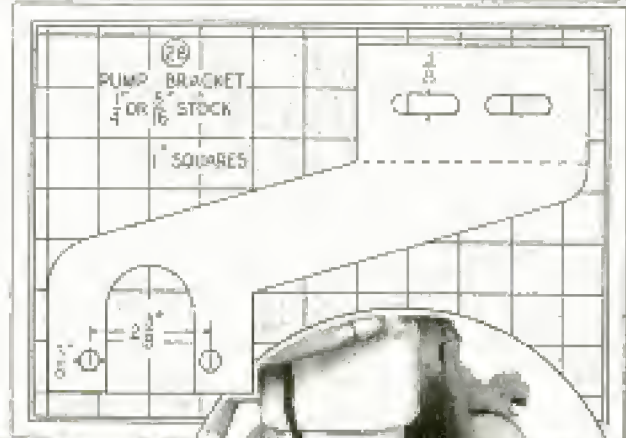
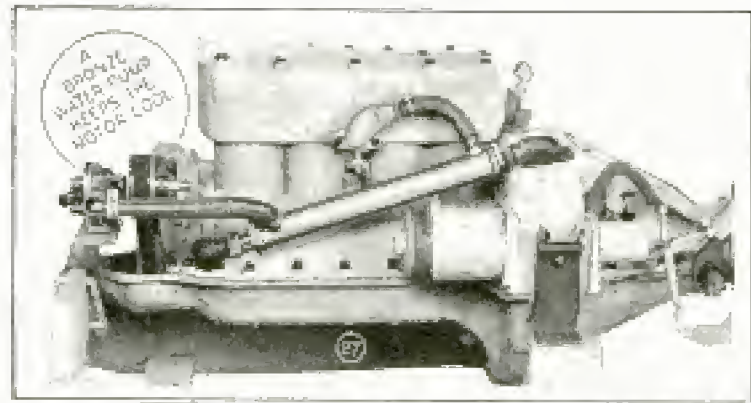
Start making the oil cooler with a $1\frac{3}{4}$ -in. heavy brass tubing, 15 in. long, threaded at each end. Two $\frac{1}{2}$ -in. holes, one at either end, are drilled, and short pieces of $\frac{1}{2}$ -in. pipe are brazed or soldered in place, as in Fig. 7. Eleven $\frac{1}{4}$ -in. tubes make up the inside of the unit, these being soldered to disks at either end. The completed arrangement is slipped inside the large tube, as shown in Fig. 5, and securely soldered

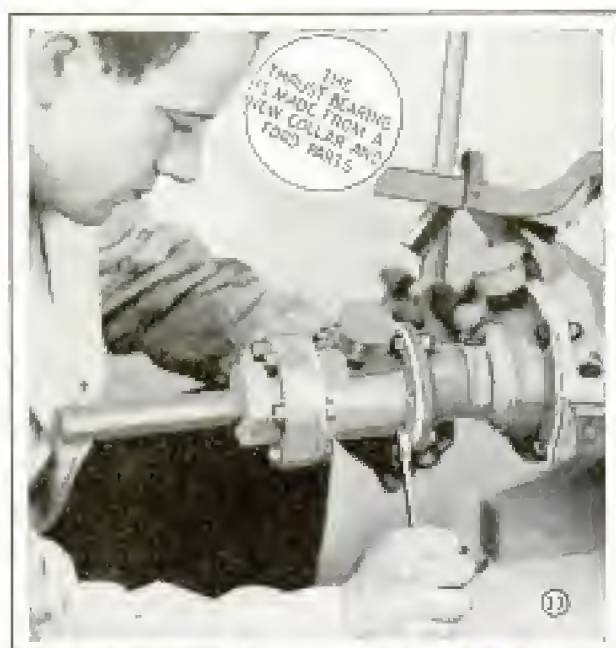


at either end, just outside the pipe connections, as in Fig. 6. You can get a good idea of the finished oil cooler by referring to Fig. 7 and studying the photographs of the finished motor. Each end of the large tube is sealed with a hexagon plug—you can get them at your plumber's—into which is tapped, at one end, a $1\frac{1}{4}$ -in. length of $\frac{3}{4}$ -in. pipe, and, at the other, a 2-in. length of $\frac{3}{4}$ -in. brass tubing. As the pipe used is measured by nominal inside diameter and the tubing by nominal outside diameter, the length of brass tubing will slide neatly inside a short brass nipple, which is fitted with a packing nut, as seen at the left in Fig. 7. Complete dimensions are not given for this oil-carrying and cooling unit as these can be better taken from the job. The principle is easily seen, oil flowing from end to end through the small tubes, while the $\frac{1}{2}$ -in. take-offs provide an inlet and an outlet for cooling water.

Getting back to the control arrangement, Fig. 14 is a view of the completed job which gives full speed forward, neutral and 96-per-cent reverse when used in connection with the transmission changes already mentioned. Fig. 15 shows the first piece to be fitted—the brake lever, a detail of which is given in Fig. 17. Fig. 16 shows the reverse arm in place. It is simply the original Ford reverse pedal, with the pedal cut off and the shank drilled with a $\frac{5}{16}$ -in. hole to take a Ford slow-speed connecting clevis. A $5\frac{1}{2}$ -in. length of $\frac{5}{16}$ -in. rod, fitted over a length of pipe, is turned into the clevis and terminates with another clevis at the free end, as indicated. The reverse arm is contracted and bent outward. No dimensions are given, the arm simply being lined up with the reverse connection, which is to go on later.

Fig. 18 is the control-lever support. This is given two right-angle bends and is then bolted in place over the universal ball cap, as shown in Fig. 19. The free end of the piece is fitted with a Ford

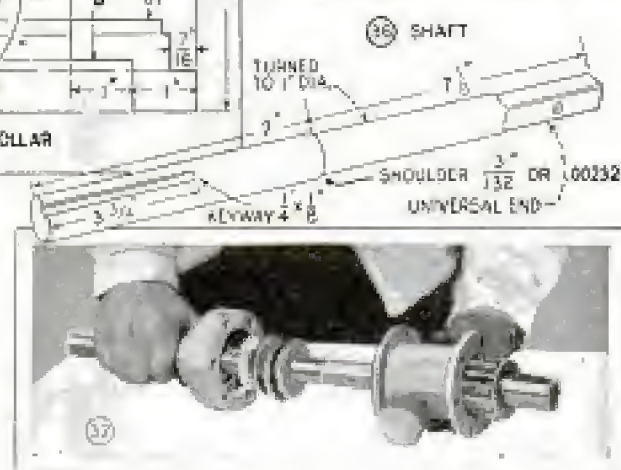
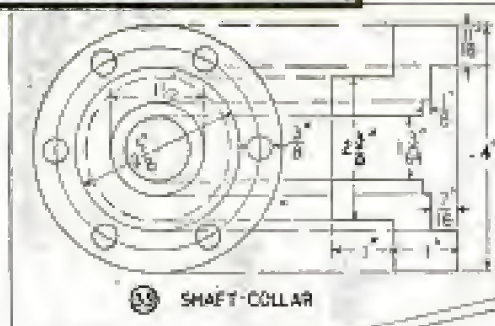




controller-shaft bracket. Into this bracket is fitted the actual control shaft and lever. The former is made by cutting a Ford controller shaft, as shown in Fig. 20, and drilling a new hole for the control lever. The original Ford speed lever is too short for the job, so you will have to braze an extension to the end, as shown in Fig. 21. Then take a short piece of angle iron, cut it as in Fig. 22 and bend it to the shape indicated in Fig. 23. The joint is to be welded, and the whole inside angle built up so that the indicated V-notch can be cut out. Fig. 24 shows this angle piece being brazed to the speed lever, the union being at about right angles to the speed-lever arm. The last new piece to be made is the reverse connection, shown in Fig. 25. This is bolted to the Ford hand-brake lever. Then the lever is fitted over the control shaft and fastened with the pin provided for this purpose, as shown in Fig. 26. Going back to Fig. 14,

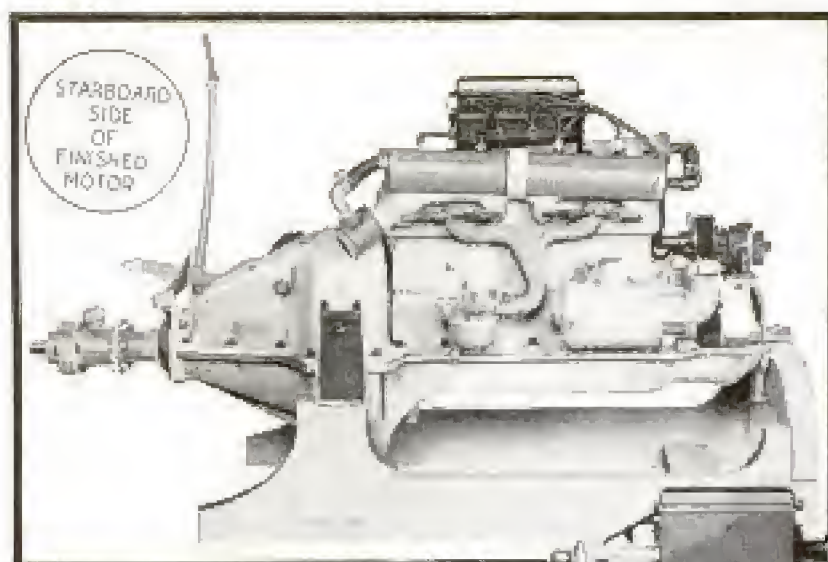
you can see that the reverse connection ties up with the reverse arm, the latter being bent out to fit. The motor is neutral when the lever is upright; full speed ahead finds the lever forward, and full speed astern, back. Some adjustments on the reverse connecting rod and the clutch-lever screw may be necessary before you get the thing working just right.

Unit No. 3 is the cooling system. This calls for a bracket shaped according to the dimensions given in Fig. 28. It can be made from $\frac{1}{4}$ -in. stock, bent to shape, or from separate pieces of $\frac{3}{16}$ -in. stock welded. Figs. 27 and 29 show how this bracket is fitted onto the front motor bracket. The long slots in the bracket take a standard $\frac{1}{4}$ -in. bronze water pump, which ties up with the original fan pulley. The pump must be purchased and fitted with a $3\frac{1}{2}$ -in. pulley to make a 1:1 ratio to the motor-driven shaft. A length of $\frac{3}{4}$ -in. hose is fitted over the pump outlet, the free end being carried to the end of the oil cooler. After passing through the latter, the water is carried to the motor by means of another hose. The fitting at this point is a Ford water-inlet connection, turned over and



fitted with a $1\frac{3}{4}$ by $\frac{1}{2}$ -in. reducer. The hose connection here should carry a compression spring so that it will not buckle, in fact, placing of springs in all hose connections is good practice.

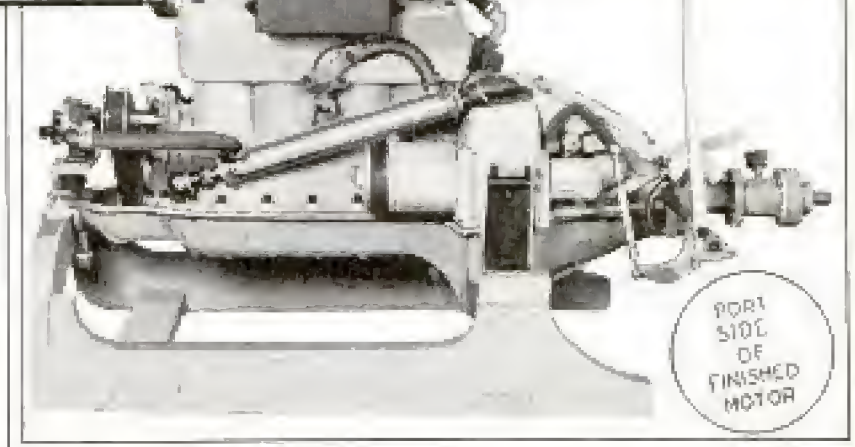
Fig. 30 shows the construction of the manifold cooler. The black-iron pipe is not used here by choice, as it has certain



drawbacks, but brass pipe is expensive and galvanized is useless when welded. It will do with an occasional flushing. You will notice that the cooler is simply a welding job—a quarter section from the pipe, an angle welded in and caps at either end. Each cap is tapped for a short $\frac{1}{2}$ -in. nipple. Fig. 31 shows the general assembly. Copper gauze should be padded around the exhaust manifold before fitting the cooler, in order to distribute the heat better. A strong metal clip, fastened to the central cylinder-head bolt, holds the unit securely. The motor connection is a water connection filed flat, with a $1\frac{1}{4}$ by $\frac{1}{2}$ -in. reducer brazed in to take a $\frac{1}{2}$ -in. nipple over which the hose is clipped. The end of the exhaust is fitted with a $1\frac{1}{4}$ by $\frac{1}{2}$ by $1\frac{3}{4}$ -in. tee, which makes a connection to the cooler by means of a suitable length of hose.

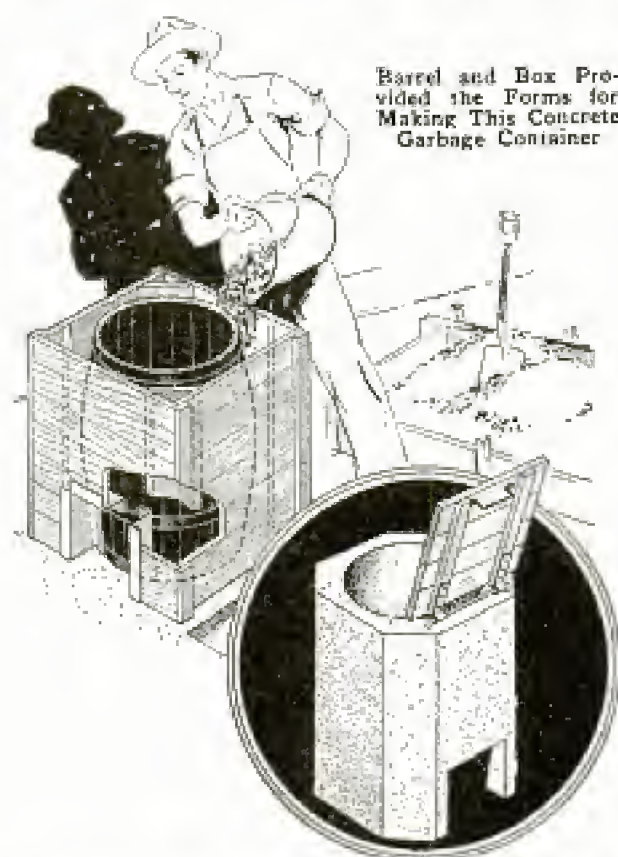
Fig. 31 pictures a more or less "in-between" job, which is common to both the thrust bearing and the control unit. The rear end of a Ford driveshaft tube is cut off and brazed to a Ford universal housing, likewise cut off to the dimensions indicated. Be sure to have the rear universal ball cap in place when you do the brazing, for it simply won't slip over either end.

Fig. 33 shows the completed thrust bearing being bolted into place. This unit is largely taken from a Ford with a few new pieces added. The various parts of



the bearing are shown in Fig. 34 with all of the parts labeled. The shaft collar (No. 4) is new and is detailed in Fig. 35. The felt washer to fit inside this is also new. It will be necessary to tool the inside of the flanges on the roller-bearing housing so that the bolts can be fitted. Note, too, that a Ford grease cup has been added to the housing. Fig. 36 shows the shaft. This is a regular Ford part with a little machining to furnish a stop shoulder for the ball-thrust collar. The free end of the shaft should be machined to the same dimension as the propeller shaft used, and fitted with a keyway and set to take a flange coupling. Fig. 37 shows the arrangement of the different parts as they are fitted together.

And here's your finished motor. Of course, you can get there a whole lot quicker if you buy the conversion parts. These are fashioned somewhat along the same lines as the units described. At any rate, the converted Ford makes an ideal power plant, and although it may not give you the highest speed and power rating, it is thoroughly economical and practical.



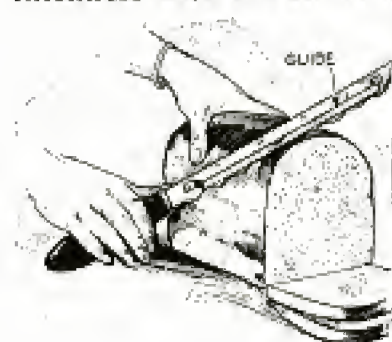
Barrel and Box Provided the Forms for Making This Concrete Garbage Container

Concrete Garbage-Container Forms Made from Barrel and Packing Box

Using an ordinary barrel and a packing box for forms, I made a concrete garbage container with little labor. There should be a 2-in. clearance between the box and the largest diameter of the barrel when both are set in position. Boards placed diagonally across each corner of the box will give the effect shown in the circular inset. The scoop hole at the bottom is made by inserting a piece of sheet metal in a hole cut in the box. After the concrete has set, the barrel can be removed by tearing the staves apart with a prybar. —Geo. A. Boswin, Chicago.

Slicing Bread Uniformly

You can cut slices of bread the same thickness with the aid of a guide attached to the knife as shown. It is made from a hacksaw blade, the ends of which are annealed to permit bending and drilling for rivets



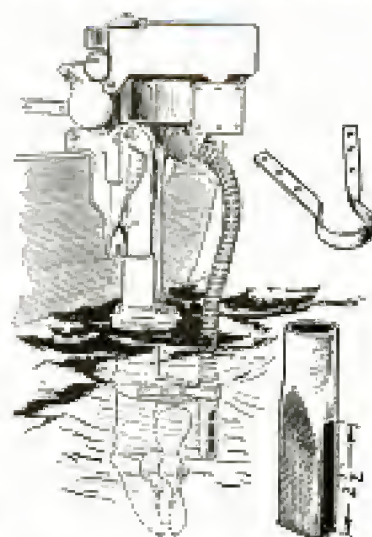
with which the guide is attached to the knife blade. The thickness of the slices, of course, is determined by the distance of the guide from the knife.

Ground Glass Can Be Produced with Emery Stone

You can easily make a ground glass for your camera, or for any other purpose, by rubbing the glass with a piece of coarse emery or silicon-carbide stone that is free from oil or grease. A little water applied to the stone will be helpful. The coarser the stone used the whiter the glass will be. Light bulbs and bottles can also be frosted in this way, but emery cloth or sandpaper is better to use for this purpose.

Flexible Tubing Provides Underwater Exhaust for Outboard Motor

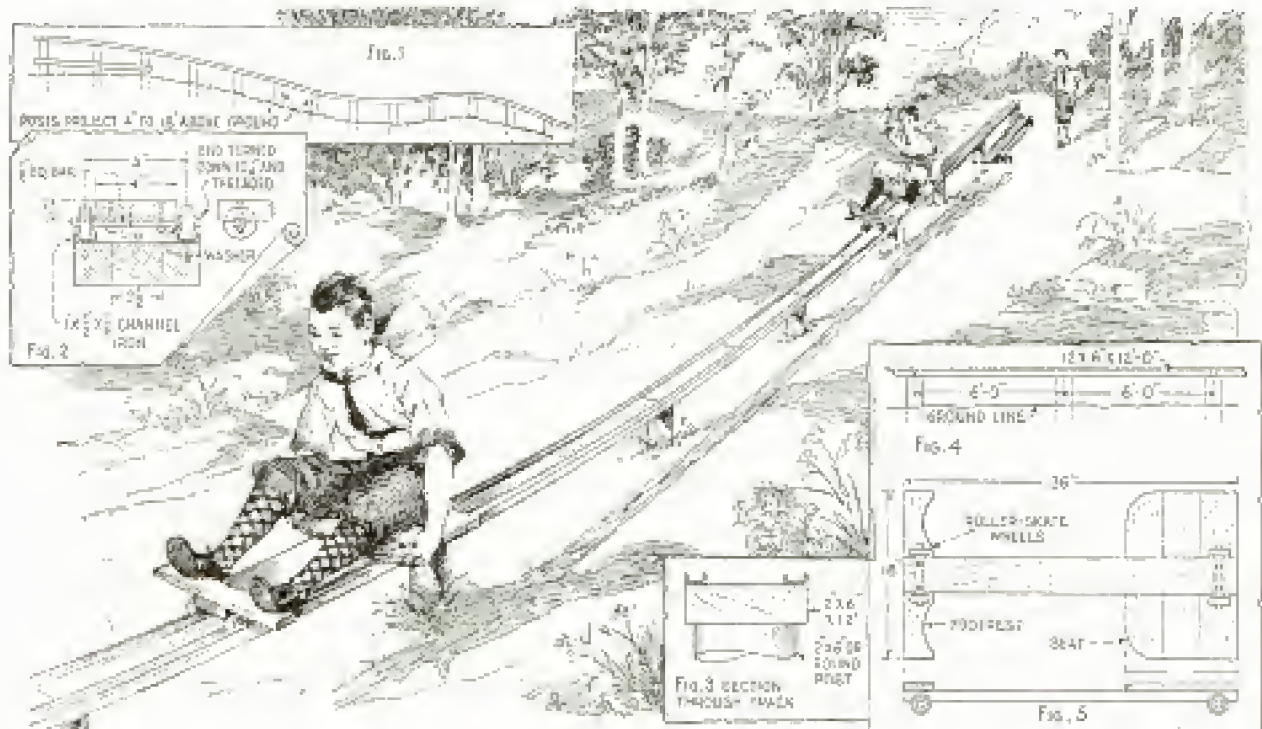
An underwater exhaust for your outboard motor, can be made by removing the original muffler and attaching a suitable length of flexible asbestos-lined tubing. One end is brazed to the exhaust manifold, while the other end extends under the water and is fitted to a length of sheet-metal tubing, flattened and cut as shown in the detail. The lower part of this assembly is held in position by a length of strap iron, bent around and brazed to the tubing and then riveted to the horizontal part of the propeller-shaft housing.



Rubber Pad on Drawing Board Serves to Grip Paper

A sheet of rubber, of suitable size to cover the top of a drawing board, will often eliminate the need of tacking the paper to the board, as the rubber provides sufficient friction. It will also help to keep pencils, brushes, etc., from rolling off.

Fun in Your Backyard with a Roller Coaster

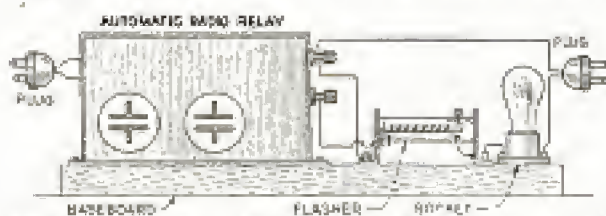


You don't have to go to an amusement park for the thrills of a roller coaster for you can build one in an empty lot or perhaps your own backyard. A slight slope is the best location, as it is then unnecessary to build the starting point very high above the ground. Posts, about 6 in. in diameter, are driven into the ground at 6-ft. intervals, and at such a height that a sloping track is obtained when 2 by 6-in. boards, 12 ft. long, are spiked to the tops of the posts, as in Fig. 1. Two tracks of $\frac{1}{2}$ by $\frac{3}{4}$ -in. channel iron, obtainable at

most implement stores, are screwed onto the boards as indicated, the tracks being perfectly parallel to each other at all points and spaced as indicated. Holes are drilled and countersunk for flat-head screws. The construction of the carts is simple. They are made as shown in Figs. 2 to 5 inclusive, ball-bearing roller-skate wheels being fitted to axles, turned to size from lengths of $\frac{1}{2}$ -in. square stock. The ends of the axles are threaded for nuts to hold the wheels securely.—H. N. Whitmore, M. E., Oak Park, Ill.

Sign Flasher for Heavy-Duty Work

By using an automatic radio switch, you can make a sign flasher. Remove the shielding from the regular thermostatic sign flasher, mount it on a suitable baseboard between two angle brackets, and next to this mount a porcelain lamp receptacle. Now connect the radio switch,

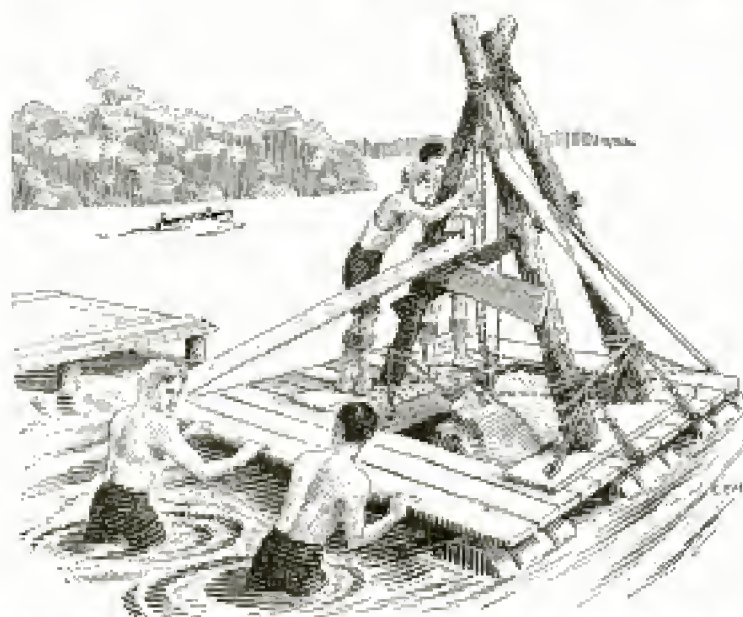


An Automatic Radio Switch Is Utilized to Make This Heavy-Duty Flasher

flasher, receptacle and two plugs as shown, and screw a 50-watt lamp into the receptacle. The lamps to be flashed are plugged into the sockets shown on the side of the switch, timing the period of interruptions by adjusting the small screw on the flasher.—John A. Kendall, New York City.

An Efficient Metal Polish

An efficient luster-producing metal polish consists of 9 lb. of tripoli and 1 lb. of tartaric acid thoroughly mixed. To use the polish, dampen a cloth and touch it to the powder. Brisk rubbing with the cloth will quickly produce a good finish.



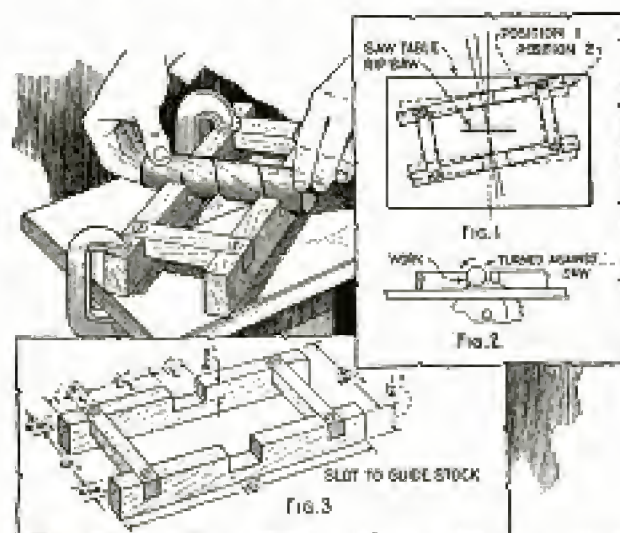
Oil-Drum Raft Fitted with Hoist to Raise Submerged Rocks and Move Them to Deep Water

Chain Hoist on Raft Moves Large Rocks from Shallow Water

Improved from oil drums and boards, this raft was used to move large, submerged rocks that interfered with docking at a summer camp. A tripod of poles was erected on the raft and fitted with a chain hoist with which the rocks were raised and then carried out to deeper water.—John D. Roberts, Meriden, Conn.

Cutting Spirals on a Power Saw

This jig for cutting spirals on a power saw eliminates the tedious work of cutting them with a handsaw. First, make a hardwood cradle to support and guide the work as shown in Fig. 3. The guide slots



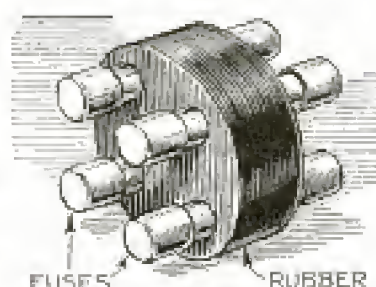
Spirals Are Easily Cut on a Power Saw by Holding the Work in This Jig

in the sides of the cradle are made wide enough to allow the work to turn without pinching. Clamp the cradle upon a saw table at an angle, Fig. 1, placing the slots off the center of the saw as much as the diameter of the work, as in Fig. 2. This is important, as it causes the revolving saw to press the stock against the side of the slots, eliminating chatter and any tendency for the work to be kicked out of position. The pitch of the spiral is governed by the angle between the saw and cradle. Stand to the rear of the saw, steady the work with your left hand, and turn it slowly in the same direction the saw is running. If a double spiral is desired, start the end

of the first spiral directly on top of the stock and the second one will then start on the opposite side.—Jules Siekman, Harvey, Ill.

Rubber Disk Holds Auto Fuses

To prevent the loss of fuses and always have a supply handy for my auto, I inserted four fuses in holes drilled through a rubber disk as shown. When a fuse burns out, I need only to pull out the old one, turn the rubber disk and put in the new.

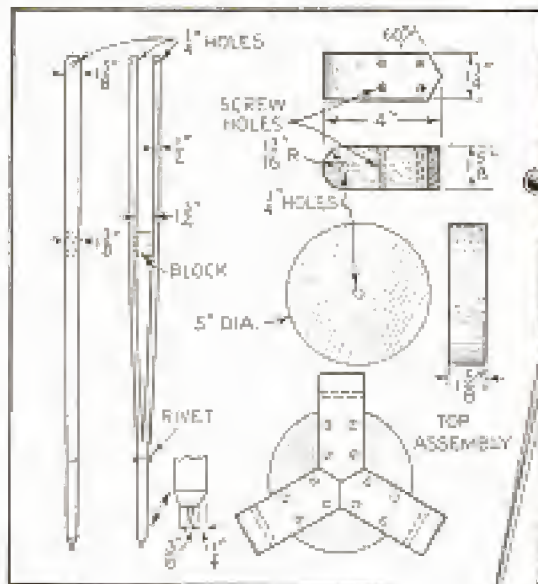


—F. B. Stoner, Jr., Riverside, Calif.

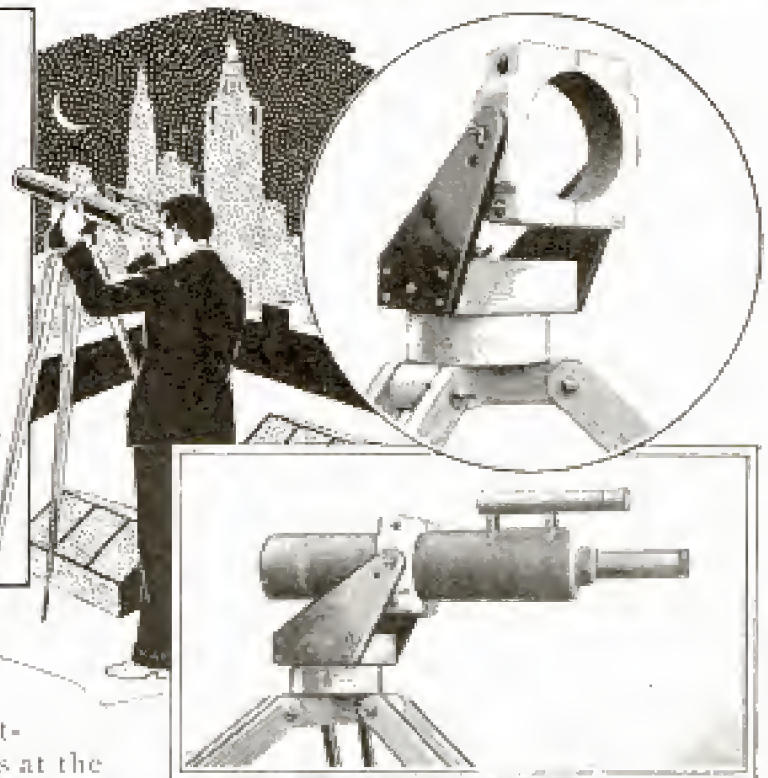
Trick Writing Paper

Paper upon which visible colored writing may be produced by using pure water instead of ink is prepared by rubbing ordinary paper with a mixture consisting of 1 dr. of finely powdered copper sulphate and 2 dr. finely powdered prussian blue. Considerable pressure should be used in rubbing the well mixed powder into the surface of the paper, and the excess powder is shaken off. Writing produced by using water in the pen will be reddish brown.

Making a Rigid Tripod for Small Telescopes



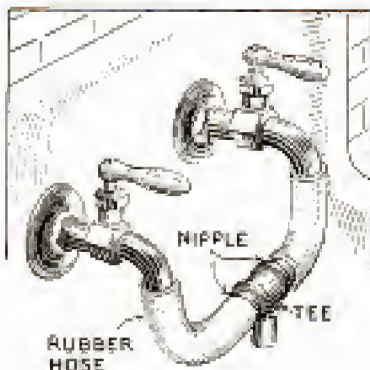
Here's a heavy, rigid tripod for a telescope, camera, surveying table, transit head or level. Three legs are cut square at the bottom and tapered to $1\frac{3}{4}$ in. thickness at the top. Their length depends upon the use intended, and can be varied to suit. They are rounded and drilled before making the saw cut lengthwise from the top to within 6 in. of the bottom end, which is then beveled off and a nail inserted to provide a sharp point. A rivet or machine screw is used to prevent the saw cut from splitting to the end. The three hinge blocks are cut, drilled and screwed to a 5-in. disk, as shown. Then $\frac{1}{4}$ by $3\frac{1}{2}$ -in. carriage bolts, with washers and wingnuts, are used to hinge the top ends of the legs to the blocks. For holding a telescope, the brack-



et shown at the right is attached to the tripod. It consists of a base block, two flat-iron sides and a two-piece, felt-lined wooden sleeve, pivoted between the sides. In use, the telescope is held in the sleeve which can be adjusted at any desired angle. A camera can be attached to the tripod by continuing the center hole in the disk through the hinge blocks for insertion of a wingbolt. The thread on this bolt should be No. $\frac{1}{4}$ -20, and long enough to let the end extend $\frac{1}{4}$ in. beyond the top. —J. Brubaker, Evanston, Ill.

Single Outlet for Sink Faucets

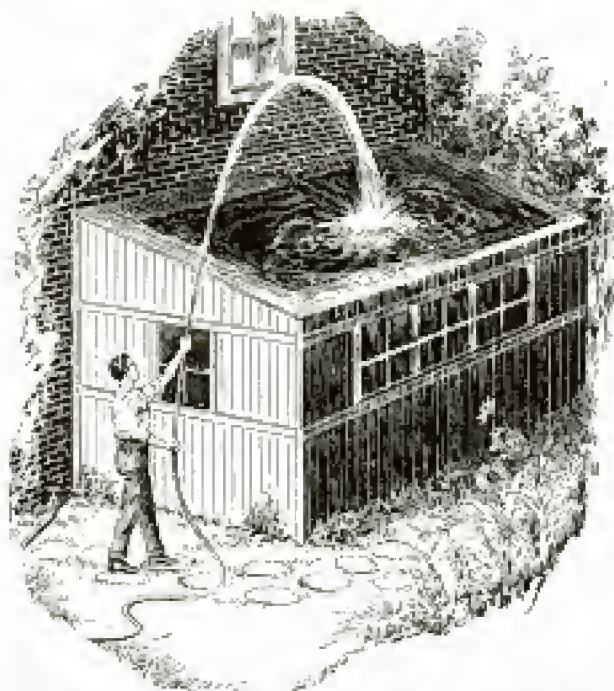
Kitchen sinks that are not provided with a single outlet for mixing hot and cold water, can be fitted with one made from two lengths of rubber hose, two pipe nipples and a tee. The pieces of hose are slipped on the two faucets



and joined in the middle by a nipple screwed into the tee.

Saturated Canvas Strip Keeps Lice off Trees

Messy whitewash buckets are done away with by the following method of keeping ground lice from getting onto trees. A strip of heavy lint or light canvas, about 6 or 8 in. wide, is thoroughly saturated in a solution made by stirring naphthol or naphthalene flakes in warm water. The strip is banded around the tree and held in place with small tacks.



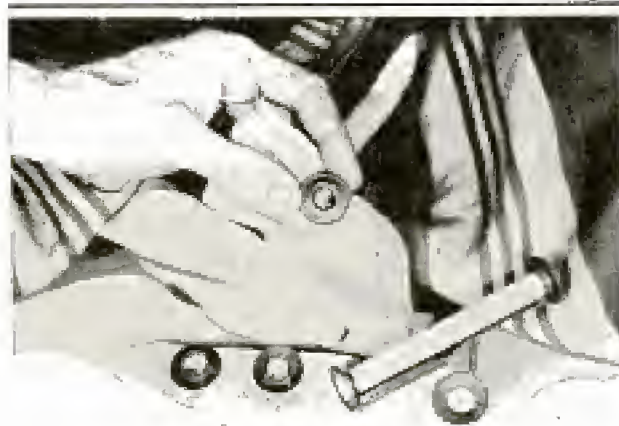
Sprinkling Carpet-Covered Roof Two or Three Times a Day Reduces Inside Temperature

Evaporation of Water on Roof Cools Interior

Temperature inside of low, flat sheds, such as a lean-to, kitchen or laundry, can be reduced several degrees on hot days by placing some old rugs on the roof and keeping them wet. Rapid evaporation takes place, and this action not only reduces absorption of heat but actually robs the roof of heat already present.

Awning Grommets Improvised from Ends of Film Spools

Strong grommets, for use on awnings, tents and tarpaulins, can be quickly formed from the metal ends of film spools. It is an easy matter to pull the ends off



Good Substitutes for Grommets Can Be Made from Ends of Film Spools

the spools with a pair of pliers, then split the small flange into four sections with a cold chisel. These sections are put through the hole in the canvas and flattened against it on the other side.

Celluloid Used for Mounting Photos

When mounting small photographs, a thick piece of transparent celluloid placed over the work will hold it down and enable you to see the photo so that it can be kept in the correct position while pasting it down. Paste is applied to the back of the work, which is mounted in the regular way, pressing on the surface of the celluloid to obtain good adherence.

Egg Beater Mixes Paint Quickly

For mixing small quantities of cold-water paint, an ordinary egg beater can be used to advantage. The whirling blades break up the hard lumps, and mix the water and dry powder much quicker than can be done with an ordinary stirring paddle. This is good not only for cold-water paint, but also for oil paints, if a beater of the heavy-duty type is used.



Making Dovetail Joints with Back and Coping Saw

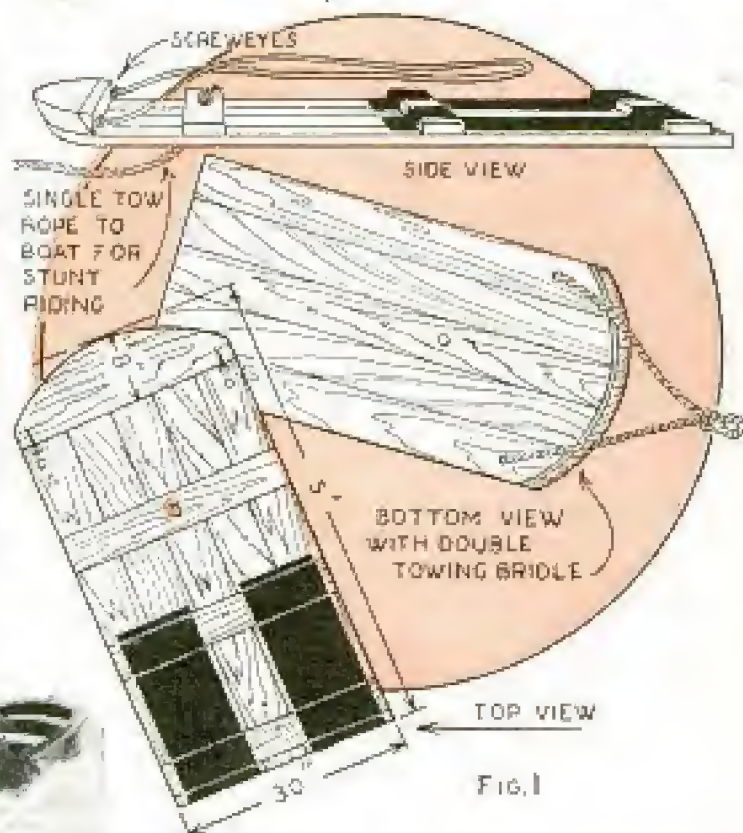
A hammer and chisel are not necessary in making dovetail joints, if you have a back and coping saw handy. First mark off the joint, then clamp the work vertically in a vise and make the straight cuts with the backsaw. Next place the work flat on the bench and cut out the waste material with the coping saw. This not only saves time, but lessens the chance of splitting the work.

THRILLS

on an Aquaplane

BESIDES fitting your aquaplane with an inflated rubber horse, there are endless forms of amusement such as jumping, gliding in the air with a set of wings, and playing marine adaptations of various games, that make the sport more fascinating.

Philippine mahogany is the best wood for an aquaplane, although cedar, spruce or cypress will do if the former is not available. Flat-head brass screws are used, and the reins and tow bridle should be of cotton rope. Dimensions and method of construction are shown in Fig. 1. Five 1 by 6-in. planks are laid in position after the edges have been carefully



jointed with a plane, and crosspieces of the same stock are then screwed on securely, after which a semicircular bow is marked and sawed off. It is advisable to use $1\frac{3}{4}$ -in. screws to join the component pieces, the screws being driven in from both sides to obtain additional strength. All edges of the crosspieces should be bev-

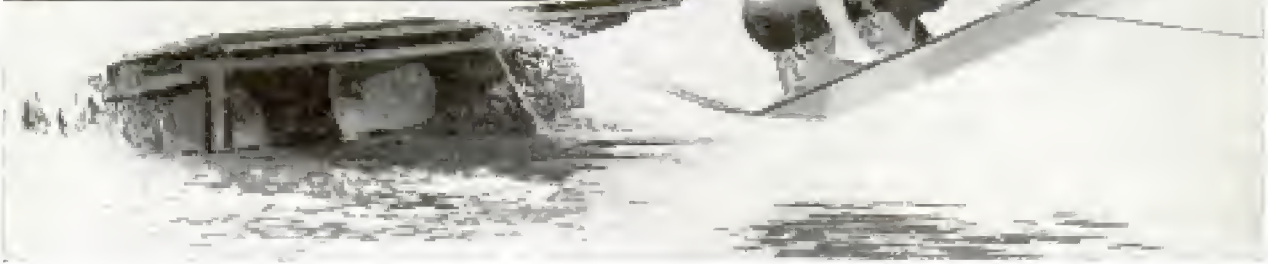
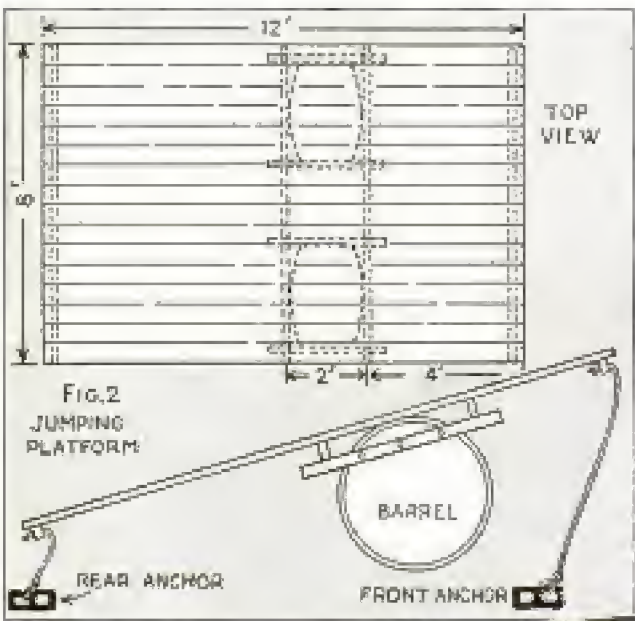


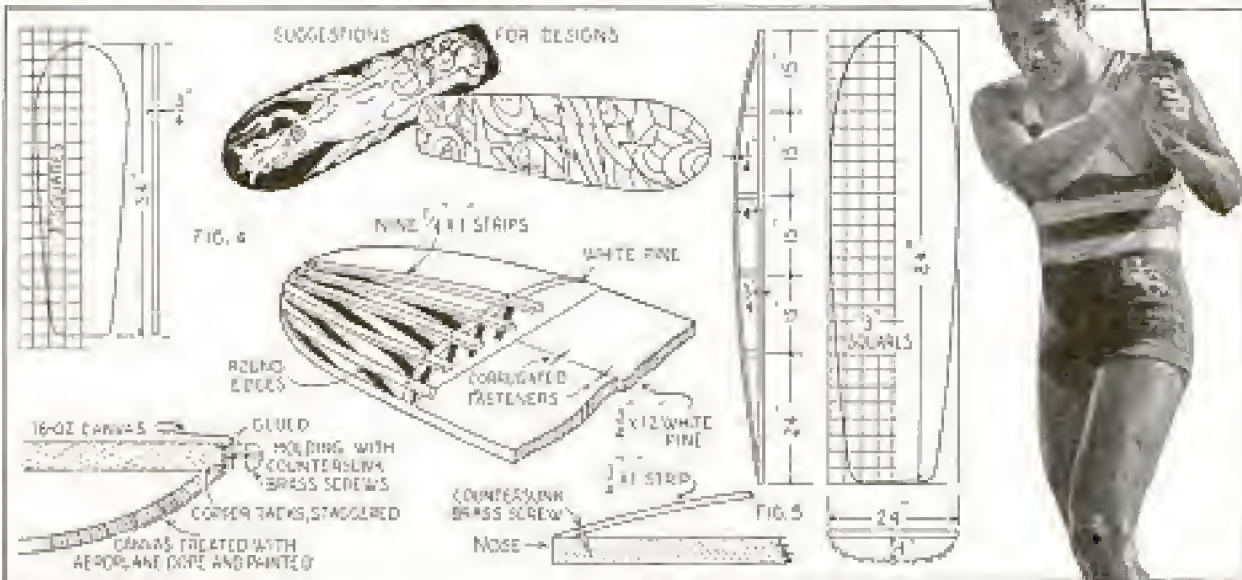
eled as well as the outer edges of the whole board. The bow piece, of 3 by 8-in. stock, 30 in. long, is then added and is sawed off at an angle. It prevents the plane from diving even when the rider spills, and also tripping on sharp turns. Corrugated rubber mats are tacked on, extending over the two rear crosspieces near the outer edges of the



frame so that the rider can keep his feet far apart in order to maintain his balance better. Screweyes are driven into the bow piece for the attachment of the

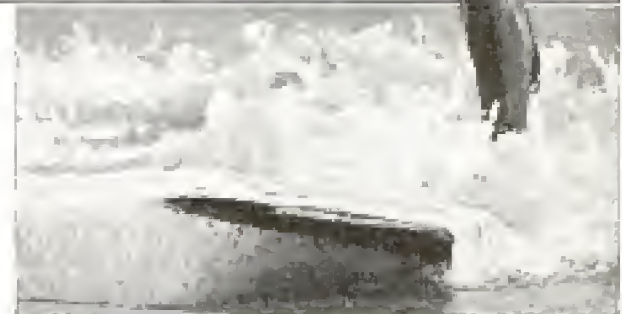
rein, which should be 4½ ft. long and have several knots tied about 4 in. apart, to enable the rider to grip it firmly, while the towing bridle is threaded through a hole or holes drilled entirely through the front crosspiece in the bottom. It is a good idea to provide a swivel joint on the towing bridle so as to prevent snarling and unwinding of the rope. A single tow rope is generally used for stunt-ing, while a double bridle gives greater



LAUNCHING RAFT
FIG. 3

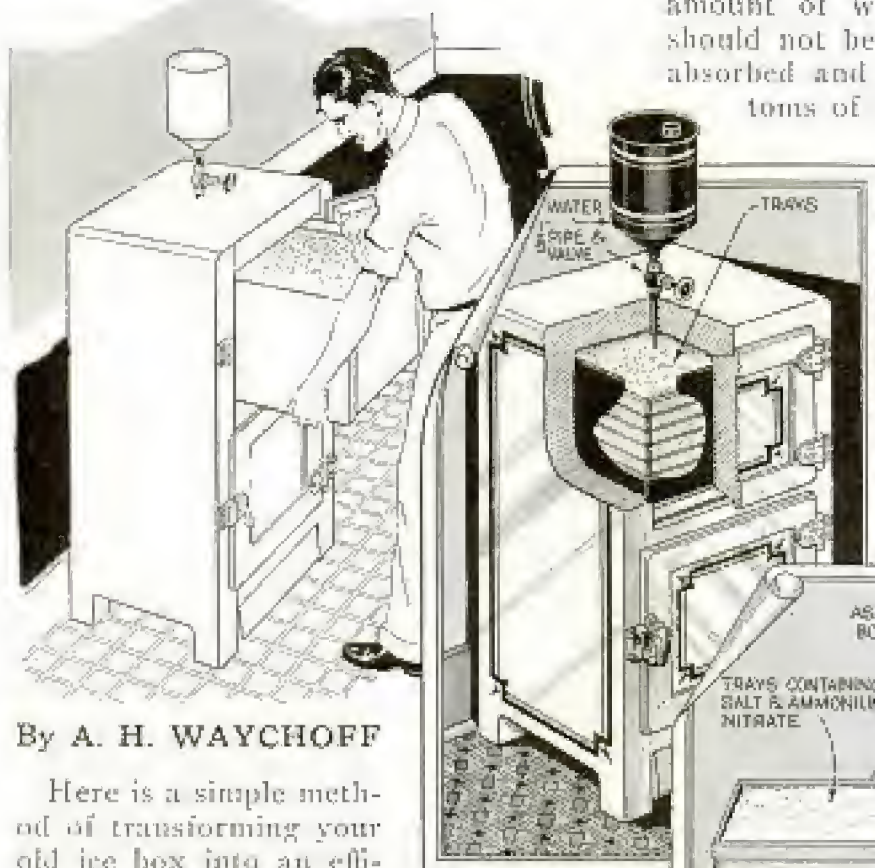
stability and is especially suitable for beginners in this sport.

Fig. 2 shows a successful jumping platform, 8 ft. wide and 12 ft. long. It is mounted on a couple of oil drums and securely anchored at both front and rear ends. If desired, a launching raft, as indicated in Fig. 3, can also be provided, the same general method of assembly being followed as in the jumping platform. A number of variations in skiboard design are shown in Fig. 4. In this construction, the bottom is rounded, being built up of a number of light strips covered with canvas, treated with airplane dope and then



painted and varnished. When attaching the strips and molding, it is best to use flat-head brass screws. Also the canvas should be tacked with a double row of staggered copper tacks for the same reason.

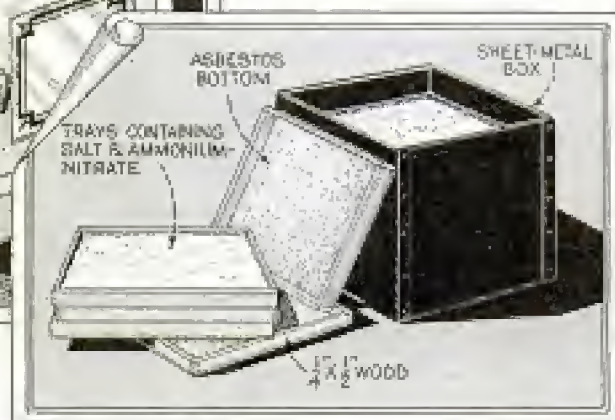
You Can Make This Chemical Refrigerator



By A. H. WAYCHOFF

Here is a simple method of transforming your old ice box into an efficient chemical refrigerator, which does its cooling by virtue of the rapid evaporation of an ammonium-nitrate solution. First make an open-top sheet-metal box, that will fit inside the ice compartment snugly. The bottom should be perforated for drainage. Then make a number of trays, $\frac{1}{2}$ in. deep, with sides of $\frac{1}{4}$ by $\frac{1}{2}$ -in. wooden strips and bottoms of sheet asbestos or insulating wallboard. The wooden sides should be impregnated with hot paraffin or asphaltum, while dry and before the bottoms are tacked on, to prevent warping and deterioration caused by intermittent heating and cooling. Each tray is then filled with a mixture of common salt, one part, and ammonium nitrate, two parts, the salt being included to prevent caking while the ammonium nitrate is evaporating. Through the center of the top, run a length of $\frac{1}{8}$ -in. copper pipe fitted with a valve, soldering the pipe to the lining of the ice box where it passes through the latter. Connect the pipe to a container for water in any convenient manner, so that water can be supplied on the stacked trays, a drop at a time. Intense cold will be produced. The total

amount of water admitted in one day should not be more than can be readily absorbed and held by the asbestos bottoms of the trays. More than this will not evaporate and will cause considerable loss of chemicals. When the mixture in the trays has become thoroughly saturated, after 24 or 36 hours of use, the chemicals will lose their cooling property, and then it is time to substitute another set of freshly prepared trays. The wet



trays are placed in the sun to dry. Ammonium nitrate, which is commonly used as a fertilizer, is cheap and the cost is very little higher than that of ice.

Tobacco Can Amplifies Buzzer

Screwed to an empty tobacco can as shown in the drawing, an ordinary buzzer



can be made to produce a greatly intensified sound. The can acts as a resonator and is attached to the wall. The lid is removed. This device was found especially

helpful on an elevator where a loud buzzer was desired.

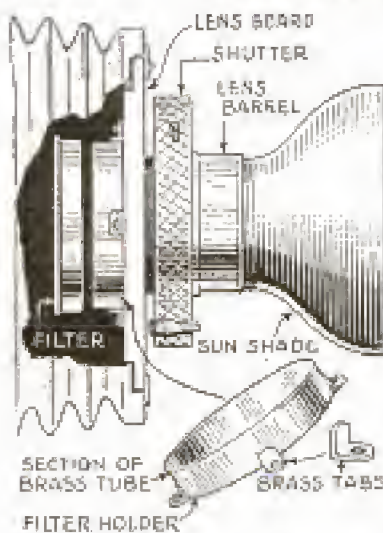
Treated Paper Keeps Away Moths

To prepare paper for use in clothes closets, etc., in order to make them moth-proof, impregnate the paper with a mixture consisting of 1 lb. moth balls or crude naphthalene and 2 lb. of paraffin. These ingredients are carefully melted over a slow heat to avoid fire. The mixture, while melted, is applied to the paper with a broad brush, ordinary brown wrapping paper being used, as it will not tear easily. Moths will not attack clothing stored in paper prepared in this way.

Waterproofing Straw Hats

A waterproofing compound for straw hats, which will not discolor them, is made by dissolving 4 oz. of shellac and $\frac{1}{2}$ oz. of sandarac in 16 oz. of wood alcohol. When dissolved, add $\frac{1}{2}$ oz. of venice turpentine and 1 dr. of castor oil. The hat is painted inside and out with the well mixed solution. It may be colored at the same time if an aniline dye is added to the waterproofing compound.

Filter behind Camera Lens Permits Use of Sunshade



A filter and a sunshade can be used on a camera at the same time by mounting the former behind the lens inside of the bellows. Brass tabs are soldered to a brass ring of suitable diameter to fit the lens and the filter frame. The tabs are drilled to take wood screws with which the assembly is attached to the lens board, after which the sunshade is slipped on outside.

■ To give white shellac a translucent color add a base consisting of aniline dye dissolved in glycerine, the strength of the color being determined by the proportions.



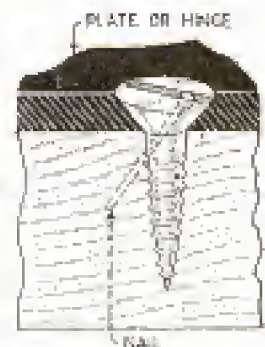
Adjustable for Seeds of Various Sizes. This Planter Also Digs the Furrow

This Garden-Seed Planter Digs Its Own Furrow

Now you can have an inexpensive seed planter that will make a furrow and accurately plant the seed in one operation. The handle is a 6-ft. length of $1\frac{1}{8}$ -in. stock, tapering from 3 in. to $2\frac{1}{4}$ in. To this is bolted a cupped disk. The container consists of two halves of a tin can, one to telescope over the other. Each half has corresponding diamond-shaped holes cut in it, which must be accurately spaced. The outer half is turned to make the hole the right size to drop the seeds. A furrowing tool is cut out of $\frac{1}{8}$ -in. iron and bolted to the end of the handle.

Brad Prevents Removal of Screw

Theft of doorway and porch accessories, such as mailboxes, ornamental hinges, door knockers, etc., can be avoided by fastening the screws so that they will be difficult, if not impossible, to loosen by ordinary methods. One way is to drill a small hole diagonally through the screw head to receive a small brad.

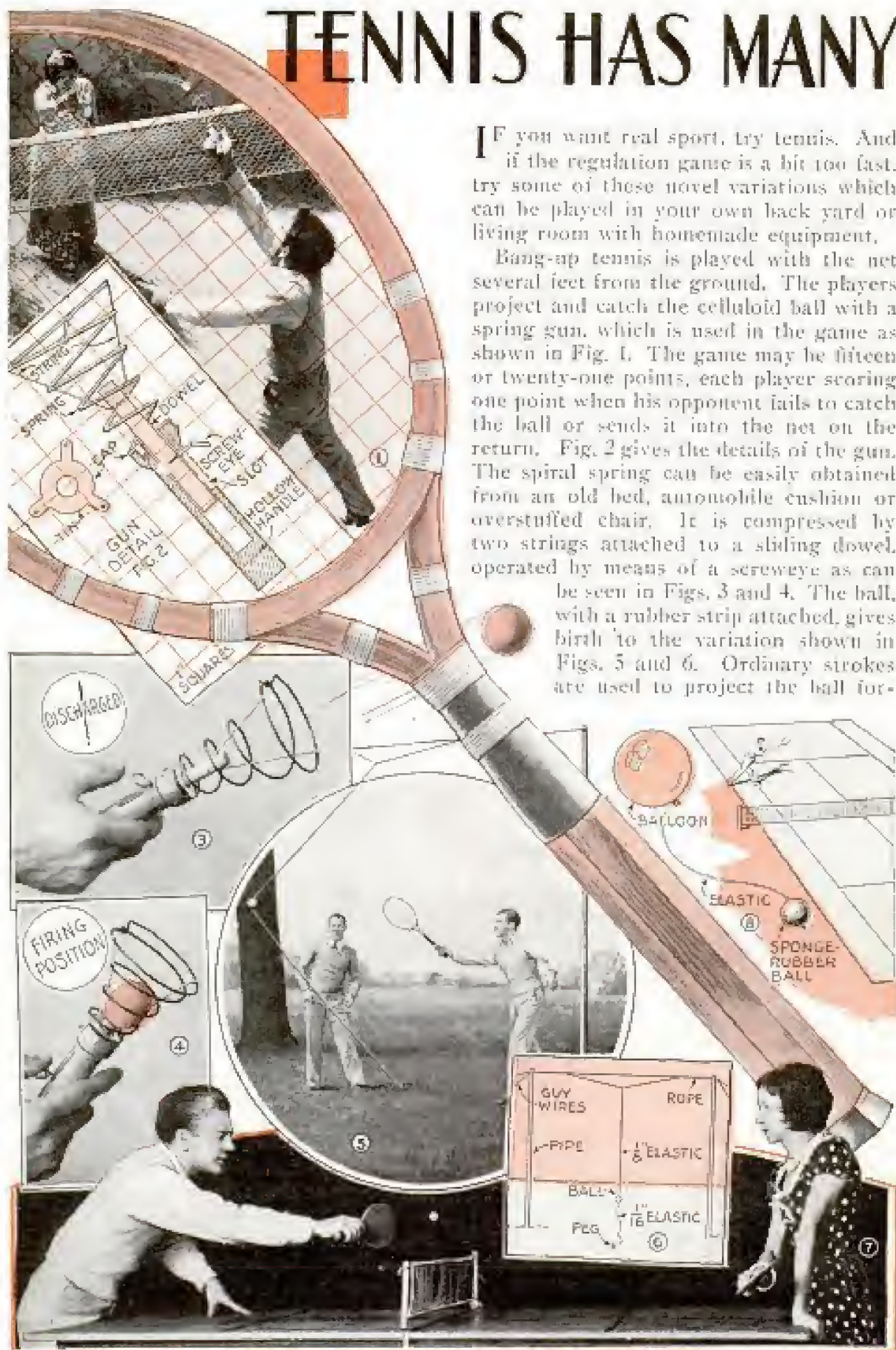


TENNIS HAS MANY

IF you want real sport, try tennis. And if the regulation game is a bit too fast, try some of these novel variations which can be played in your own back yard or living room with homemade equipment.

Bang-up tennis is played with the net several feet from the ground. The players project and catch the celluloid ball with a spring gun, which is used in the game as shown in Fig. 1. The game may be fifteen or twenty-one points, each player scoring one point when his opponent fails to catch the ball or sends it into the net on the return. Fig. 2 gives the details of the gun. The spiral spring can be easily obtained from an old bed, automobile cushion or overstuffed chair. It is compressed by two strings attached to a sliding dowel, operated by means of a screw-eye as can

be seen in Figs. 3 and 4. The ball, with a rubber strip attached, gives birth to the variation shown in Figs. 5 and 6. Ordinary strokes are used to project the ball for-



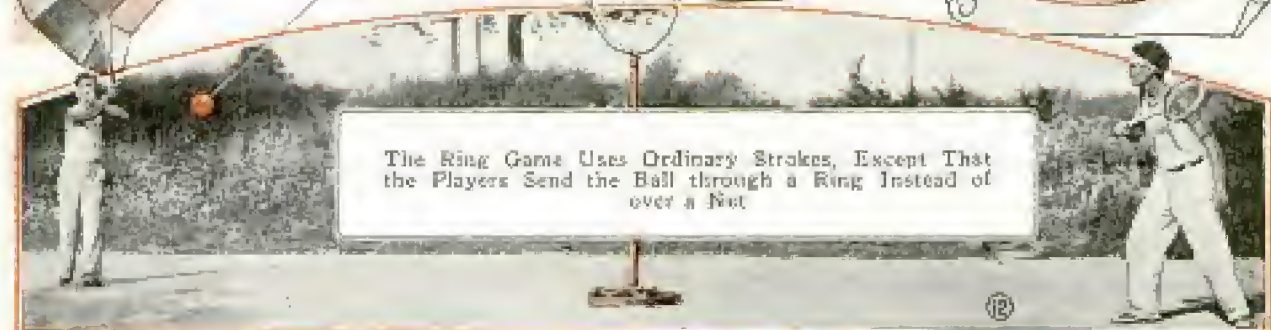
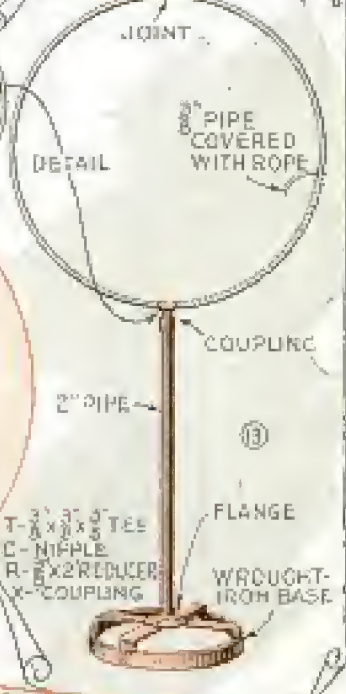
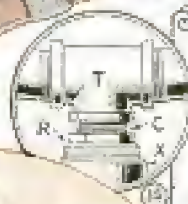
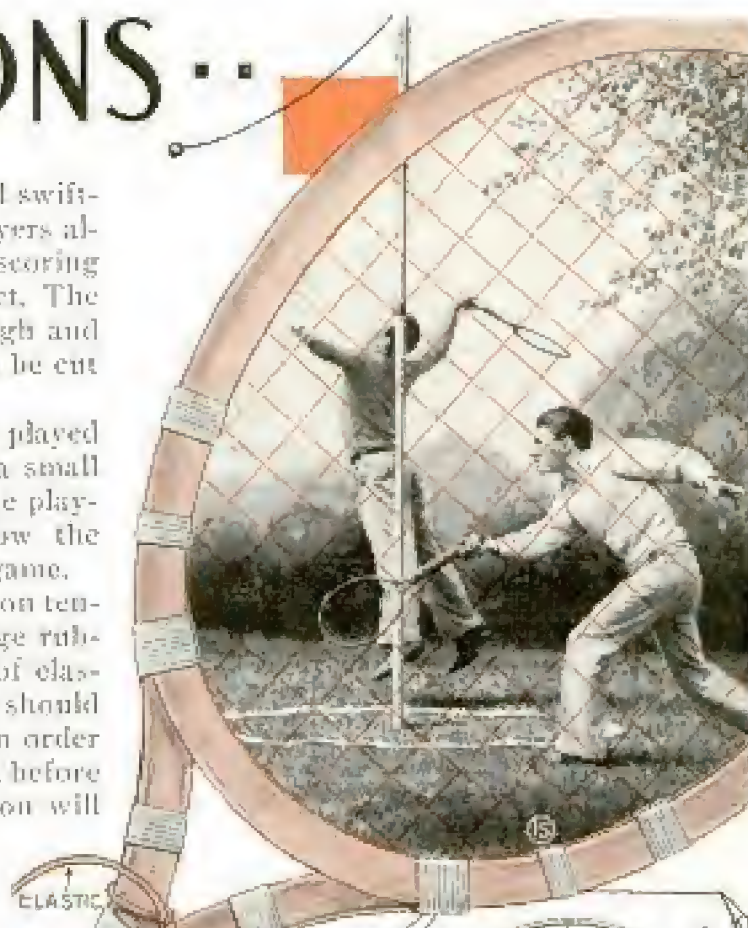
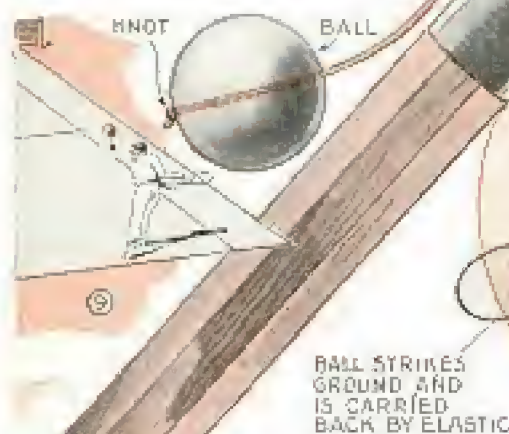
VARIATIONS...

ward, after which the ball is carried swiftly back by the elastic. The two players alternate in striking the ball, each scoring when the other fails to make contact. The two poles should be about 10 ft. high and placed 12 ft. apart. The rubber can be cut from an old inner tube.

Ping-pong tennis, Fig. 7, can be played on a table, using a cellaloid ball, a small string net and wooden paddles. The players alternate in serving and follow the scoring rules of the regular court game.

For something different, try halloon tennis, with the ball attached to a large rubber balloon by means of a length of elastic, as shown in Fig. 8. The game should be played with a rather high net in order to make volleying—striking the ball before it bounces—possible. As the balloon will retard the flight of the ball considerably, the game can be played with full swings in any large-sized living room.

For solo practice, a sponge-rubber ball, attached to the racket by a length of elastic, as shown



The Ring Game Uses Ordinary Strokes, Except That the Players Send the Ball through a Ring Instead of over a Net

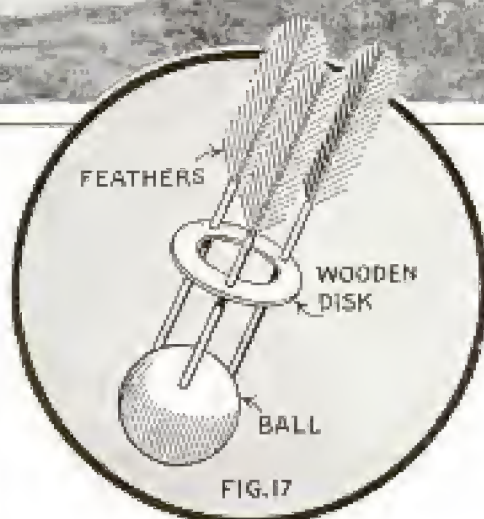


in Fig. 10, furnishes good sport. The ball is projected forward by the racket so that it will strike the ground; then, on the rebound, it is struck again, and the operation is continued until the player misses his swing. Better results can be obtained by fastening the elastic to the center of the gut, but as this often ruins the stringing, the method indicated in the sketch is offered as a workable substitute.

If you think your placement is good, try the ring-tennis game shown in Fig. 12. As is fairly obvious from the picture, the object of the game is to bat the ball back and forth through the large ring. This should be about 4-ft. in diameter and supported about 4-ft. above the ground. The constructional details of the unit are given in Figs. 13 and 14.

The equipment for tether ball, Fig. 15, consists of a 2-in. diameter pipe 10-ft. high. The ball is suspended about 2½ ft. above the ground by means of a length of cord attached to the top of the pole. About 6 ft. from the ground, a black band, 2 in. wide, is painted around the upright. The object of the game is to wrap the cord around the pole so that the ball will come to rest above the black line. Of course, you try to send the flying sphere around in one direction, while your opponent attempts to send it around in the other.

A variation of the popular game of Badminton is shown in Figs. 16 and 17. The



difference lies in the ball, which, instead of the regulation sixteen feathers, has but three, these being fastened to the sponge-rubber ball by means of some glue and the light wooden disk shown in the sketch. The game of feather ball thus evolved is played with tennis rackets in the usual manner.

The only difference is that the ball cannot be struck on the bounce; it must be caught in mid-air and returned across the net. As in balloon tennis, the ball has a slight floating motion, sufficient to allow of the game being played indoors.

Soap Slicer Made from Table Knife

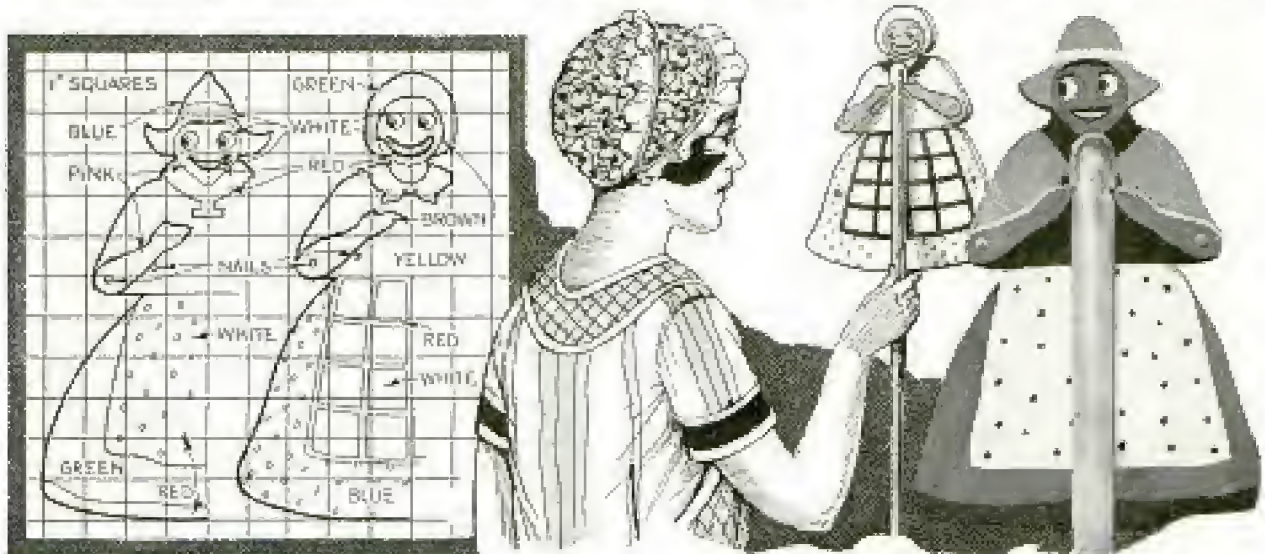
Pivoted to a wooden block and mounted on a suitable baseboard, a table knife serves nicely as a soap slicer. It is operated by sliding a cake of soap under the knife blade with one hand and pushing



down on the handle with the other. If a cut is first made the long way of the bar, the soap chips will be in halves.

Insulating wallboard, nailed to the underside of the floorboards of an auto, will keep the car cool in the summer.

"Aunt Jemima" Holds the Kitchen Broom



Only three pieces of wood are used to make these broom holders, a large piece of $\frac{1}{4}$ -in. stock for the figure and two smaller pieces for the arms. The parts can be cut out with a hand coping saw, jig or bandsaw, and the edges dressed down with a file and sandpaper. The completed holder, painted in bright colors, is attached to the wall or back of the door, and the broom is slipped up between the pivoted arms, the hands being cut down to a sharp point to fit notches cut in the broom handle. In making the figure, fold a piece of heavy wrapping paper in the center and lay out one side in 1-in. squares. The outline is then cut and the paper unfolded, after which it is traced on the wood. Brads under the arms hold them in a slightly inclined position. Although any desired color scheme can be employed, the suggestions given at the left have been found especially suited to the purpose. In order to obtain a smooth finish, the wood is carefully sanded, shellacked, and again sanded before painting.

Cellophane Used to Imitate Leaded Glass in Miniature Windows

Leaded glass in windows of model ships and houses can be imitated with cellophane and India ink. To do this, draw diagonal lines across the cellophane pane with the ink, using a ruling pen to insure uniformity. After it has dried, apply lead-gray oil paint over the ink so that about $\frac{1}{8}$ in. of the paint shows beyond each edge

of the line when viewed from the reverse side. These painted lines will represent the leading. The size of the diamond shapes thus formed will vary according to the size of the model and should be drawn in proportion to the scale adopted. If an illuminated effect inside the window is desired, paint the background a dull red and streak it with purple and yellow before the pane is glued in place.

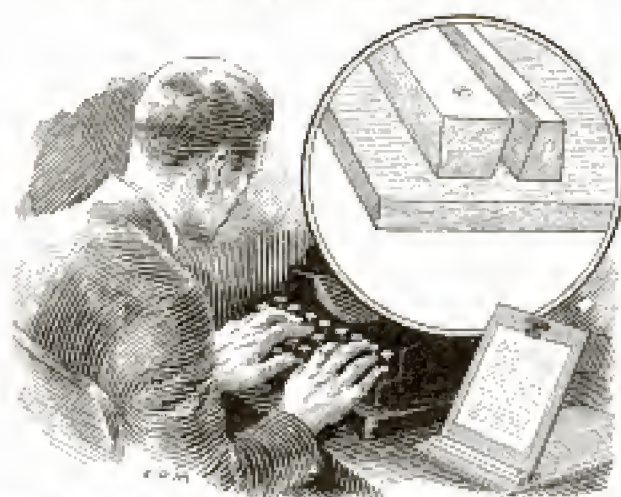
Medicine Dropper Feeds Young Birds

Bird orphans can be fed and raised to maturity, or at least to the stage where they can eat themselves, by feeding them with a medicine dropper, milk forming the largest portion of the diet. When they pass the baby stage, hard-boiled eggs, mashed fine and mixed with bread crumbs, make a good food, this being administered on the end of a match stick.



Young Birds Can Be Kept Alive by Feeding Them Milk with a Medicine Dropper

Homemade Copy Holder Aids Typist



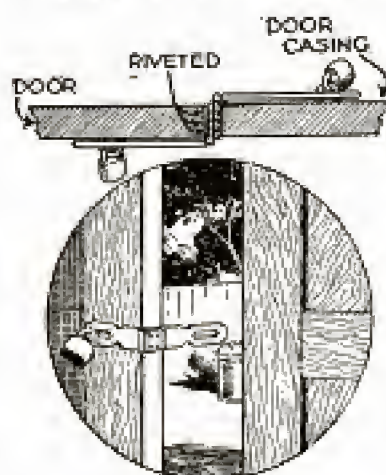
Here Is a Simple, Homemade Holder That Keeps Copy in Correct Position for the Typist

Two beveled wood strips screwed to a suitable base will hold a board for copy at a convenient angle, as shown. The board can be made from a smooth piece of wood and a paper clip.—K. F. Keith, Chicago.

How to Take Measurements for New Window Glass

When taking measurements of a window sash for the purpose of replacing broken panes, it is best to measure all four sides from wood to wood in the sash and deduct $\frac{1}{16}$ or $\frac{1}{8}$ in. to allow for expansion and irregularities. This practice is advisable, because some sashes are not true, that is, they do not form a rectangle. Single-strength glass is suitable for small panes, but double-strength should be used for larger ones.

Garage Door Locked from Either Side



In order to be able to lock or unlock his garage from either the inside or outside, a car owner riveted the short ends of two hasps together as shown. When attached in this way, the

longer ends of the hasps can be slipped over staples in the door and the casing, and both sides can be padlocked.

Removing Rear Wheel from Car

When no puller is available, the rear wheel of a car can easily be removed as follows: Unscrew the hub cap and turn the axle nut two or three times until it is flush with the end of the axle. Then place a short board against the nut and wire it to the spokes of the wheel. Drive the car under its own power for a short distance and the wheel will be loosened. The board keeps the nut from turning so that the wheel will not come off entirely after it is loosened.—E. Gray, Ogden, Utah.

Floating Film Frame Simplifies Washing of Roll Films

Attached to a wooden frame provided with hooks, roll films can be easily handled when washed in running water. This method eliminates the risk of scratching



Roll Films Held on Floating Frame Can Be Washed in Running Water without Scratching

the film which often occurs when doing the work by hand. The rack from which the film is suspended floats in the wash, and the latter is kept fresh by running water. As many as four rolls can be washed at once, if the frame is made wide enough. Its length is determined by that of the film. A coat of paint on the frame will prevent particles of wood from settling on the film.—E. J. Beck, Detroit, Mich.

Putty Is Easily Made

Boiled linseed oil and Spanish whiting kneaded into a stiff paste make a very satisfactory putty. It should be stored in air-tight cans to prevent it from becoming hard and useless.



HOMEMADE LATHE for Woodworking

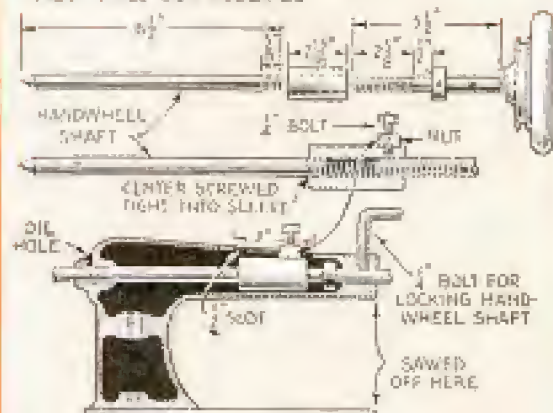
By Perry W. Trout

WITH the exception of a three-step V-pulley, all parts of this wood-working lathe can readily be made with ordinary tools found around the workshop. It consists mainly of two old sewing-machine heads, which are used for the head and tailstocks, and two lengths of angle iron to form the ways. The lathe has a capacity for 12-in. diameters and 42 in. between centers, although additional capacity in the latter respect can be obtained by providing longer ways. In this case a center support is necessary.

Fig. 1 shows the various parts of the head and tailstocks. For the former, be sure to select a sewing-machine head that is not much worn. Remove all the fittings from the casting. Next, with a hacksaw, cut off the gooseneck, as indicated by the dotted lines of the headstock detail. Also, after the slide-shuttle cover has been removed, saw off the footplate so that it will be flush with the upper part of the casting. Directly underneath this plate there is a cleat, or reinforcement, near each side, which runs the entire length of the plate. These serve as guides when mounting the castings on the ways. Reinforcing ribs that run from the center toward the edges are, however, filed down so that the casting will assume a perfectly level position



FIG. 3 TAILSTOCK ASSEMBLY



THREE-SPEED V-PULLEY FIG. 1

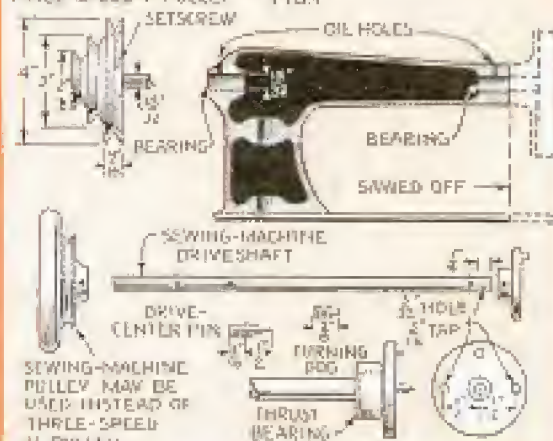
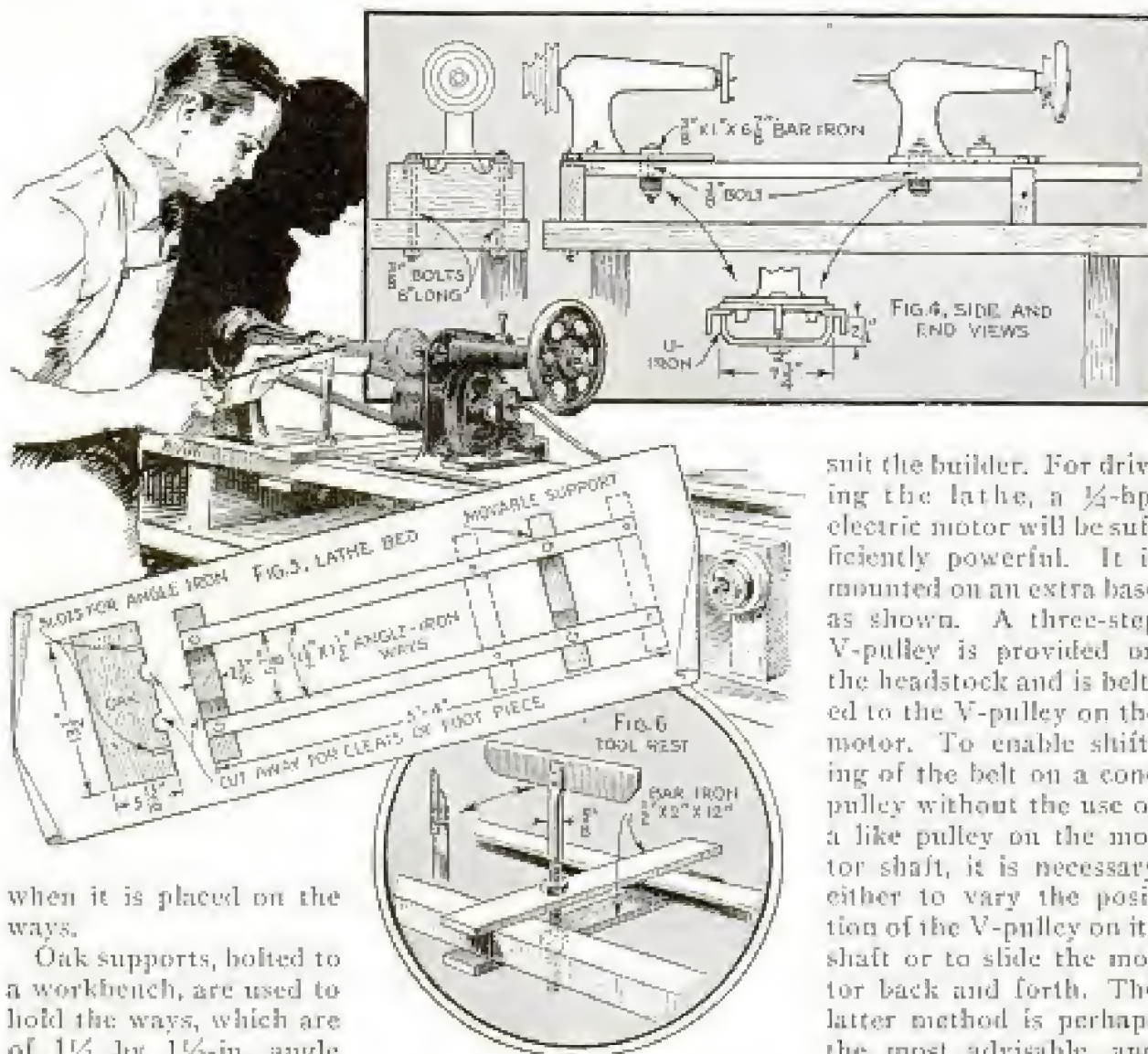


FIG. 2 DRIVESHAFT ASSEMBLY



when it is placed on the ways.

Oak supports, bolted to a workbench, are used to hold the ways, which are of $1\frac{1}{2}$ by $1\frac{1}{2}$ -in. angle iron. The arrangement of the parts is given in Figs. 4 and 5. The ways, of course, are spaced so far apart that the cleats of the footplates will fit between them. The headstock is bolted permanently in place, a length of bar iron being used to reinforce the footplate against excessive strain when the bolt is drawn up tight. A U-shaped piece of flat iron is placed underneath the ways, as indicated in the detail of Fig. 4.

In case you cannot get sewing-machine heads of the same model, it may be found that the head and tailstocks do not line up properly. This condition can be remedied by mounting one of the heads on a maple base in order to bring the centers in line. Such an alteration should preferably be made on the headstock, as it is placed permanently on the rails. Fig. 6 shows the construction of a tool rest, although the size and arrangement may be varied to

suit the builder. For driving the lathe, a $\frac{1}{4}$ -hp. electric motor will be sufficiently powerful. It is mounted on an extra base as shown. A three-step V-pulley is provided on the headstock and is belted to the V-pulley on the motor. To enable shifting of the belt on a cone pulley without the use of a like pulley on the motor shaft, it is necessary either to vary the position of the V-pulley on its shaft or to slide the motor back and forth. The latter method is perhaps the most advisable, and with this in view, it is a

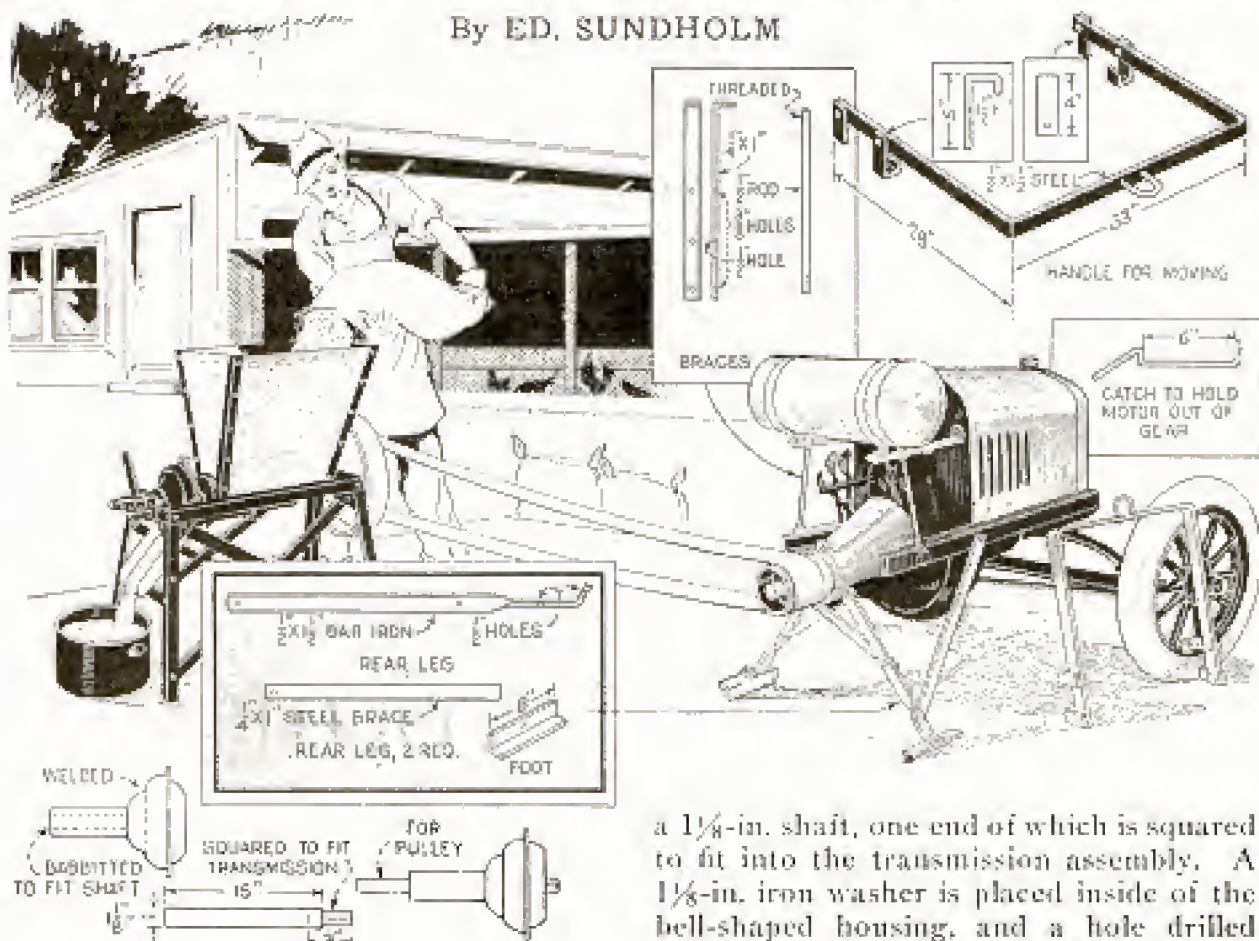
good idea to mount the motor on a sliding base that can be clamped quickly and securely in any position. If a $2\frac{3}{8}$ -in. pulley is used on the motor shaft in conjunction with a cone pulley of the size specified, a motor having a speed of 1,750 r.p.m. will give lathe speeds of 980, 1,250 and 1,750. If you cannot obtain a cone pulley, you may use the original sewing-machine pulley and a $\frac{1}{4}$ -in. round belt.

A Hint for Mixing Cement

When mixing concrete, considerable time and work can be saved if the crushed stone is put in the box first, then the sand and on top of this the cement. As the mixture is turned over the first time, have someone rake it lightly. In this way, two or three turnings will be sufficient to mix the aggregates thoroughly.

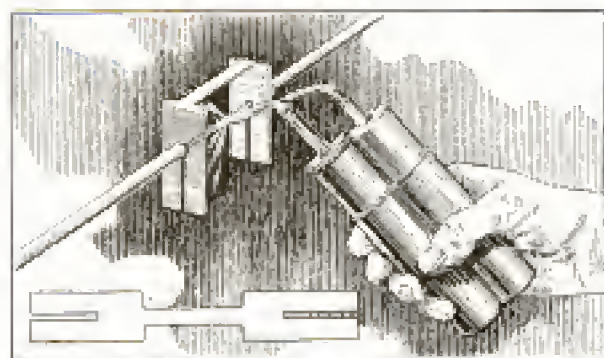
Portable Power Plant from Old Auto Motor

By ED. SUNDHOLM



With the body removed and the frame cut in two even with the rear part of the transmission, an old model T Ford makes a good portable power plant that is easily moved and occupies little space when stored. Two legs of bar iron, bolted to the universal housing to support the rear end, are fitted with angle-iron feet and braced as indicated. The driveshaft housing is cut off as shown, welded to the transmission and then babbitted to take

a 1/8-in. shaft, one end of which is squared to fit into the transmission assembly. A 1/8-in. iron washer is placed inside of the bell-shaped housing, and a hole drilled through the shaft just in front of the washer for a large cotter key to hold the assembly in position. A belt pulley of suitable size is mounted on the end of the projecting shaft. It is a good idea to make a catch fitting over the clutch pedal, to hold the transmission in neutral. A towing handle is made to fit over the rear ends of the frame, while the wheels can be locked rigidly by bolting lengths of flat iron between the steering arms and the spring shackle bolts.

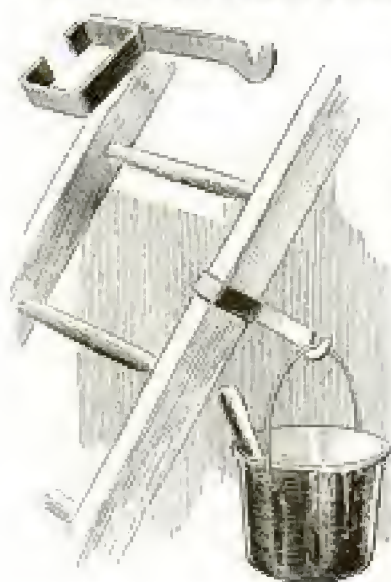


Insulation Protected When Soldering Wire with a Torch by Placing Tin Guard over Bared Section

Tin Guard Protects Insulation When Soldering Wire

When soldering a splice in an insulated wire with a small blowtorch, the insulation can be protected against the flame by hanging a U-shaped sheet-metal guard over the wire. Each leg of the guard is slotted so that it can be slipped over the wire, and to prevent it from falling off, have the legs extend far enough underneath the wire so that their weight will keep the guard in a vertical position.

Hook Holds Paint Bucket on Ladder



Where it is necessary to hold a paint bucket at various heights while progressing with the work, this sliding hook, which can be slipped up or down and set at any convenient position on the ladder, has been found to be of consid-

erable utility for painters. It is made from two pieces of rather heavy flat iron, one of which is bent to fit over the side of the ladder, a space being left between the ends to enable attachment. The other piece is cut at one end to form a hook, and is then riveted to the part that fits the ladder. The weight of the bucket clamps the hook securely in place.

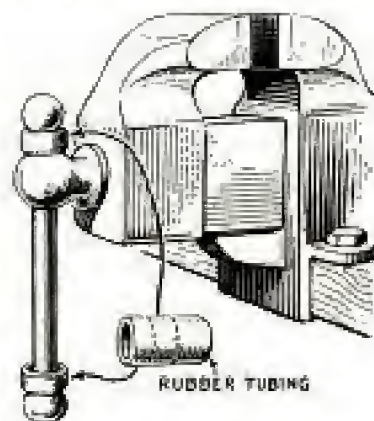
Simple Rig Saves Labor in Haymow

If you have a large haymow door in your barn, a few feet of rope can be utilized to save considerable labor at haying time. Tie a short rope between the hay fork and the carrier pulley and another, several feet in length, to the crossmember of the fork. The rope between the fork

and the pulley allows the forkful of hay to swing more freely and farther into the mow than is possible with the ordinary arrangement, and by pulling on the rope tied to the crossmember of the fork, the hay can be swung where it is wanted before being released. The proper length of rope to use between the pulley and the fork depends upon the height of the track from the bottom of the door. The rope should not be long enough to allow the hay to drag on the door when pulling it into the mow.—H. Harris, St. Paul, Minn.

Rubber Snubbers for Vise Handle

To silence the falling of a vise handle and also to avoid pinching and bruising the fingers or hand, two pieces of heavy rubber hose will be found effective. The size of the hose should be such that it can be pressed over the ball ends of the handle but will not readily slip off when once in place. Another method of attaching the snubber is to cut the hose open on one side so that it can be slipped directly on the shank, after which tape is wrapped around to hold it in place.



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Blackboard or Slating Paint

Blackboards may be made on smooth plaster walls, or from well-filled shellacked and smooth wood, by using a paint consisting of 2 oz. of fine lampblack and 8 oz. of fine pumicestone worked into 16 oz. of boiled linseed oil. To this add enough turpentine to make a total of 4 pt. of paint and stir thoroughly. The paint will dry quickly and several successive coats should be used, each one being rubbed smooth with sand or emery paper before the next is applied. Stir the paint constantly while using to prevent the settling of the lampblack and pumice.

Loosening of Machine Screws Prevented by Heating

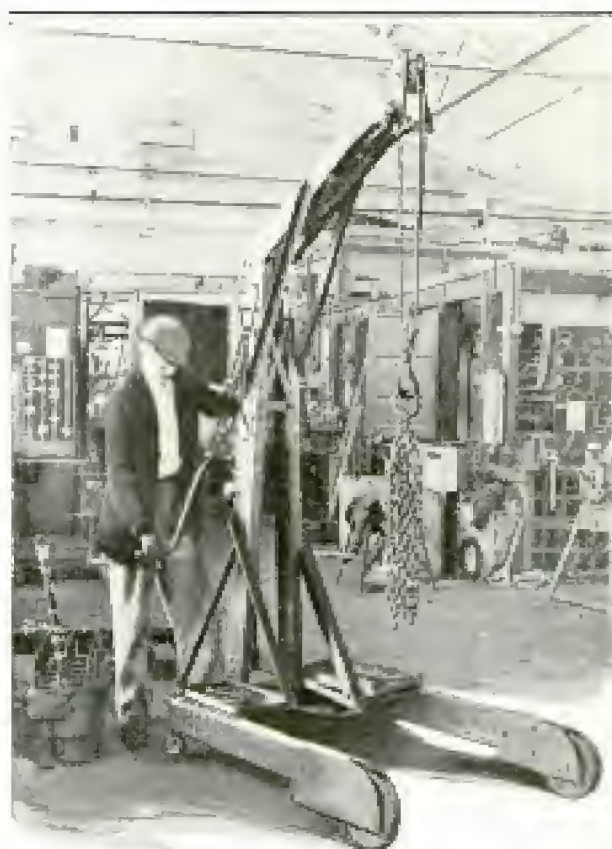
Tendency of machine screws to loosen can usually be corrected by the following method: First, be sure that the end of the screw does not touch the bottom of the hole. If it does, grind off the end. Heating a screw before inserting it into the hole will often prevent it from loosening. The contraction of the metal when it is cooling will then bring the threads of the screw into much tighter contact with the threads of the hole.—C. A. Lovell, Hutchinson, Kans.

Inflated Truck Tire Makes Portable Air Tank

A tire dealer in the west mounted a large truck tire on his service car and used it as a portable air tank. The tire carries enough air to inflate several smaller tires, and also makes a novel advertising sign when properly painted and lettered.



Large Truck Tire Mounted on Dealer's Service Car Forms Portable Air Tank for Inflating Smaller Tires

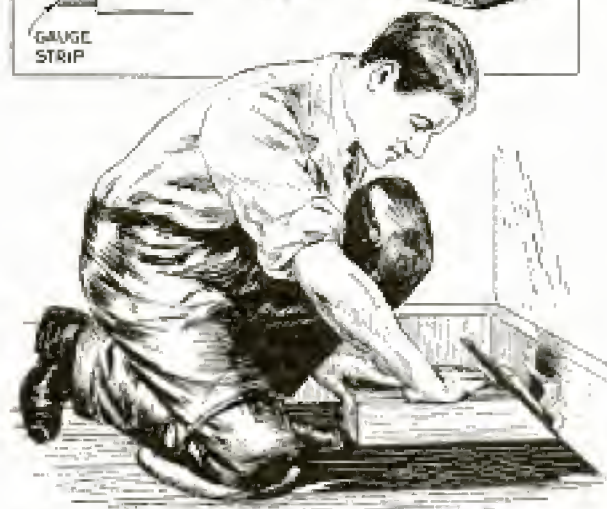
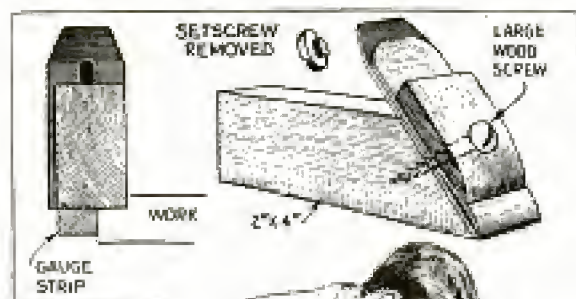


Heavy Work Raised and Moved about a Shop with This Powerful Hand Hoist

Sturdy and Economical Hand Hoist

For lifting and transporting heavy work about a shop, an economical hand hoist can be built as follows: An 11-ft. length of 6-in. channel iron, bent to a U-shape and fitted with heavy casters at one end and small wheels at the other, serves as a base. The crane consists of four lengths of 6-in. channel iron welded together at an angle, as indicated in the photo, and thoroughly braced by 2-in. angle iron. It is bolted to the base with angle plates. Pulleys, mounted at the end of the crane and just below the elbow, carry a cable to a small winding drum placed between the vertical pieces. One end of the drum has cogs, into which a pawl works to hold the load, and also a crank for winding up the cable. A metal tray is attached to each corner of the base for carrying tools.—Jos. C. Coyle, Englewood, Colo.

Ⓐ duplicate key for your car, hidden about the chassis, will enable you to get into the car if you lose the one you carry.



Bull-Nose Plane for Scraping Floors Improvised from Wooden Block and Plane Iron

A Homemade Bull-Nose Plane

In order to properly scrape a floor near the baseboard, it was necessary to use a bull-nose plane. Such a plane was not available, so I improvised one from a 10-in. length of 2 by 4-in. stock. I sawed one end at a 45° angle, made a wooden wedge 4 in. long and mounted a plane iron on the end of the block, fastening it securely with a wood screw and wedge, as indicated in the detail.—G. M. Beerbower, Hollywood, Fla.

Cone Attachment on Soldering Iron to Melt Sealing Wax



Sealing wax is easily melted with a soldering iron when this attachment is used. It consists of a sheet-metal cone with a length of tubing soldered to one side for the insertion of a soldering or

curling iron. A steel ball soldered to the head of a nail, using acid flux, serves as a stopper to control the flow of the melted wax. This attachment is useful for sealing letters and documents and is also handy for melting paraffin when sealing jelly glasses.

Fiberboard Prevents Bleeding of Cedar

To prevent bleeding of cedar chests and boxes when refinishing the outside surface, tack strips of fiberboard to the underside of the lid to seal it and prevent the escape of cedar fumes when it is closed. Bleeding is caused by a chemical action set up when cedar fumes from inside the chest come in contact with the naphtha or turpentine in the varnish. The lid should be kept sealed until the finish has completely dried.

Sandpaper Used to Hold Work Firmly in Miter Box

Have you ever had trouble with your work slipping when using a miter box? If so, tack a lining of sandpaper inside of the box. This will hold the work securely and will help in making a cleaner and straighter cut.—Fred A. Beard, Detroit, Michigan.

Bottle Covers Lot-Marking Rod

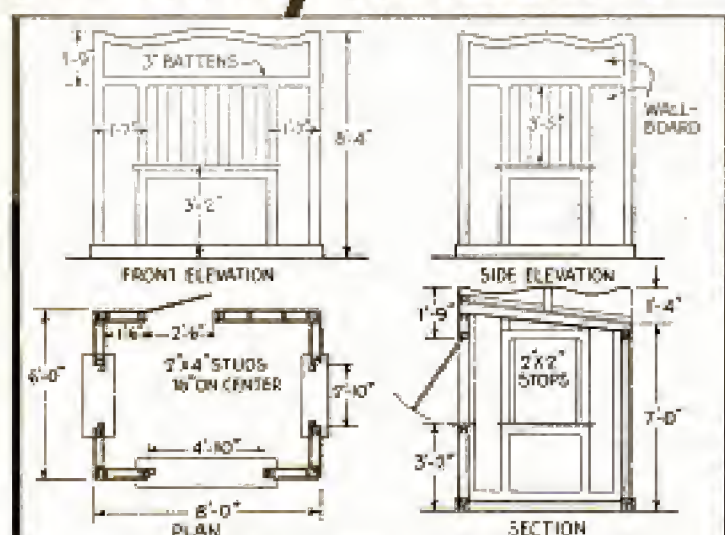
Marking rods used to designate limits of lots are often rather dangerous to children, especially if the rods are of pipe. In order to prevent the possibility of accidents, it is a good idea to drive them just a trifle below the ground and slip a small colored bottle over them so that the bottom of the bottle just projects above the ground and can be seen. Another advantage is that the stakes will not be pulled out and thrown away by children playing in the lot.



ROADSIDE STANDS



are
money makers

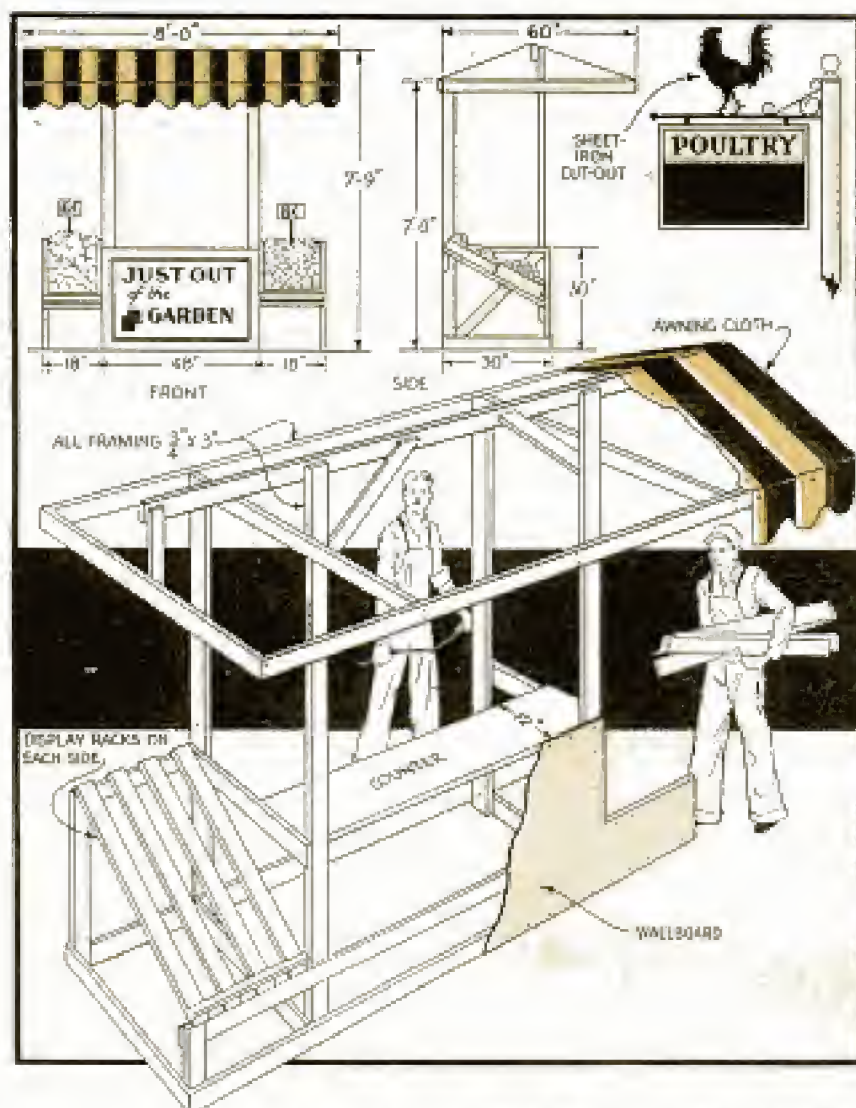


the motorist. A number of various types of highway salesrooms of simple construction are shown in the accompanying drawings.

One of general utility, that can be built by the average man, is shown above. Little wood is needed for the framing, and any good grade of heavy wallboard or plaster board can be used, provided the surface is adequately protected by several coats of paint. Pressed wood, however, is still better.

For fruits and vegetables a small and simple job is illustrated on page 164. This can be erected in front of the producer's home and involves a minimum of expense and labor. All framing is of standard $\frac{3}{4}$ by 3-in. pine, which is inexpensive if finished on one side only. Two inclined display racks are built on the sides for boxes of fruits and vegetables, and an awning cloth, stretched over the top, provides shade. The use of ordinary duck or unbleached muslin will reduce the cost considerably, but a striped material, preferably red and white, has more attraction value to halt the motorist. In addition,

SELLING home produce from the roadside direct to the consumer has proved profitable to thousands. So successful has this sales method been, that it has been applied to pottery, toys, Indian blankets, antiques, pet animals, furniture and numerous other commodities. One enterprising man in southern California has even established a roadside boat and yacht market thirty miles from the sea and carries a large stock ranging from a canoe up to a 40-ft. cruiser. Roadside stands are easy to build. One may start simply with an umbrella and packing box and expand as the business warrants. Much of the success depends upon the neatness of the stand and premises, and its accessibility to



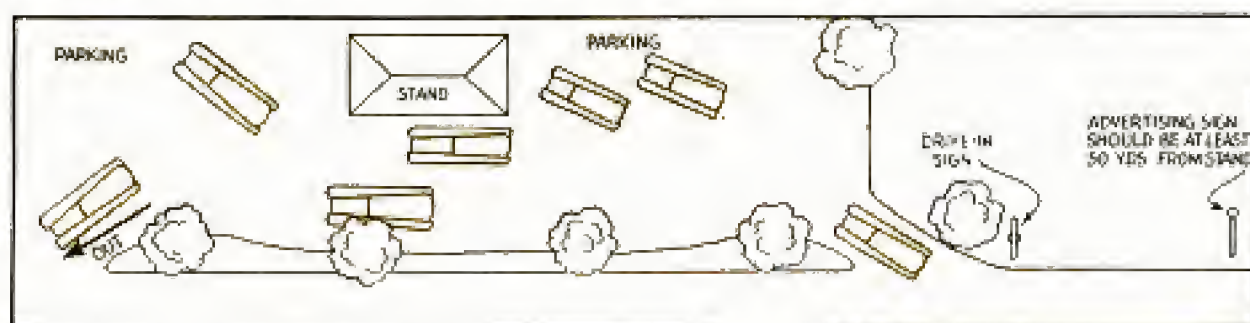
the facade of the road stand may be covered with wood or white oilcloth, providing ample space for advertising purposes. Small stands of this type can be set directly on the curb for convenience of the buyer, as the sales volume is not large and there is not likely to be any congestion of traffic.

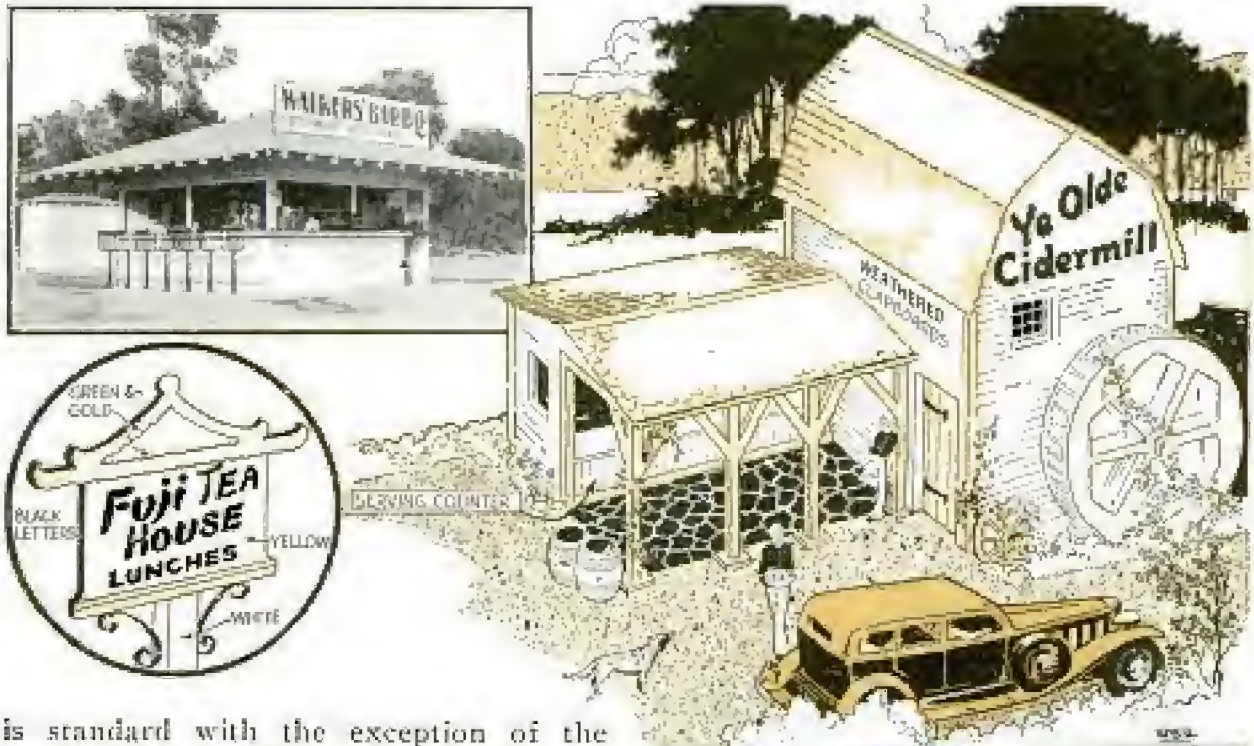
The location of the roadside stand is important, especially if selling garden produce, poultry and similar merchandise, which the customer takes home for consumption. Whenever possible, such stands

should be located on the side of the road of home-bound traffic, for many motorists will not trouble or risk crossing the road to make a purchase, but will take the chance of finding some other stand farther along on the right side. Few motorists care to buy such produce on their outbound trips. A wide drive-in and ample parking space are also desirable, as shown in the lower detail. Cautious motorists always prefer to pull off the main highway when making a stop, and if there is room to pull out past other cars parked at the stand, the establishment having sufficient space will capture much extra business. If possible, have the drive-in lead from the highway at a slight angle and place a readily visible sign just before the entrance. The advertising sign should be located at least 50 yd. up the highway so that

motorists who are traveling at average speed will be able to see it in time to make a decision to stop. Lunch stands can be located on either side of the road, as tourists—and especially children—become hungry at any and all hours. Be sure to have your stand painted in colors easily visible at a distance. White is always conspicuous and red roofs are effective.

The Japanese design on page 163 is appropriate for novelties or light lunches, and this particular model is also simple in construction. The broad-eaved hip roof

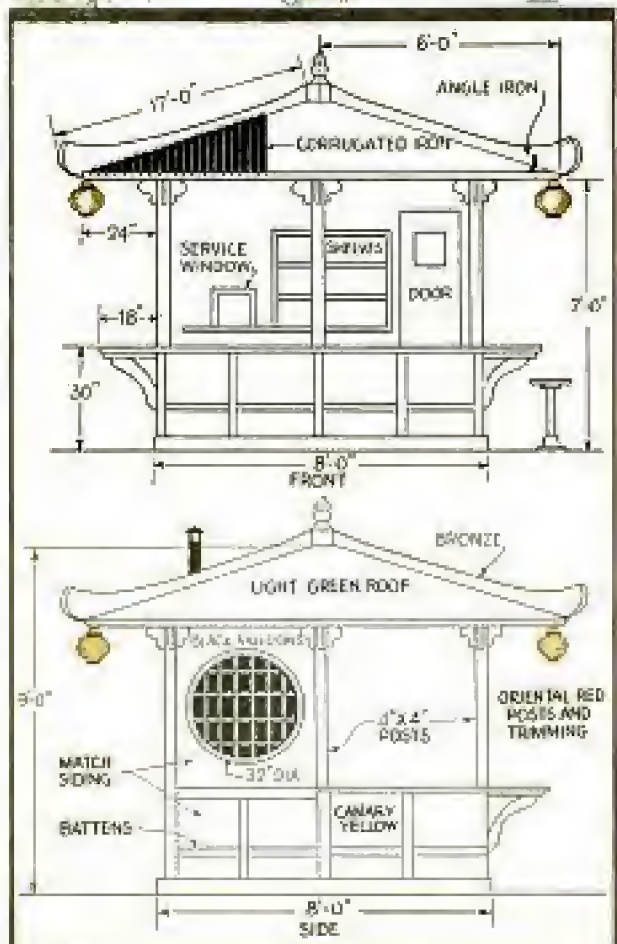




is standard with the exception of the curved ridge strips, peak ornament and corrugated-iron roofing. The ridge strips are held securely with angle irons. A central partition separates the rear, which is used for preparing food, and the front, which is open for serving at a broad counter that runs around three sides and is provided with stationary stools. Matched lumber is used for siding, with $\frac{1}{4}$ by $1\frac{1}{4}$ -in. battens for paneling. A circular opening is cut in each side wall, with a square mullioned window placed behind the opening. An effective color scheme is a light, jade-green roof with gold or bronze ridge pieces; canary-yellow walls with oriental-red posts and trim, and window mullions black. The counter should be finished or stained in natural wood and waxed. A novel advertising sign, painted in bright colors and placed well up the road, will do its bit in attracting trade. For the moderate expense involved, this is about as picturesque a stand as can be constructed.

"Ye Olde Cidermill," illustrated at the top, is a substantial structure, which can be adapted to other products after the cider and apple season. It is built along the lines of an old mill, with the surface unpainted and artificially weathered. The long serving counter under the extension accommodates many customers, and the main building can be used for storage and production, or for the serving of lunches.

Besides the suggestions shown on these



pages, it is obvious that the possibilities in variations of design are almost without limit, and may be determined by such factors as the commodity sold as well as the location,

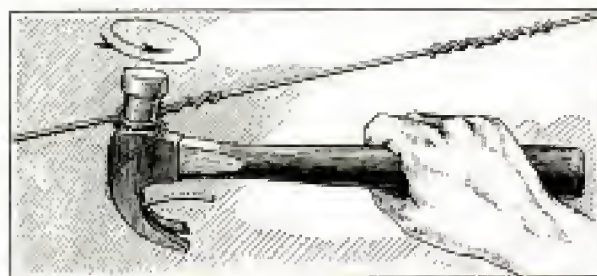
Fixture for Holding High-Power Photo Lamp



Photographers will find a flexible desk lamp fitted with a good reflector convenient when using the new 64-volt 100-watt photo bulbs. A hole drilled through the base of the lamp enables quick attachment to a tripod, as shown in the photo and drawing, while the flexible arm allows a wide range of adjustment. If the use of the tripod is undesirable at any time, the lamp may be placed on any other suitable support. For a reflector especially practical for this purpose, get one about 9 in. in diameter and 6 in. deep, sold for use with infra-red lamps.

Tightening Fence Wire with Hammer

To repair a broken length of wire on a fence, take an ordinary claw hammer and



Emergency Repair on Your Wire Fence Can Be Quickly Accomplished with Aid of a Claw Hammer

loosen the staples holding the wire to several posts on both side of the break. Then splice a short piece of wire to one of the broken ends and twist the end of this length around to form a loop. The other broken end of the fence wire is then slipped through the loop, caught between the claws and twisted around the hammer head. Stretching of the wire is then accomplished by turning the hammer in the direction indicated by the arrow, after which it is twisted around the wire several times to prevent it from loosening.—Louis F. Lenck, Lincoln, Nebr.

How to Make Solder for Glass

Solder that will adhere to glass can be made by melting together tin, 95 parts, and zinc, 5 parts. The tin is melted first and then, as it is stirred, the zinc is added a little at a time, pushing it under the surface of the molten mass to prevent fumes and oxidation. The glass is heated in an oven and the solder is held against the surface until it flows, after which the pieces of glass are held firmly together while the solder sets.

Strainer screens in gasoline feed lines can be cleaned quickly by rubbing a cake of soap over the screen, then placing it in boiling water and removing the soap with a brush.

Park & Jones, 223 W. Madison, Chicago

Vacuum Cleaner Blows Fresh Air to Worker in Tank

Upon entering a large water tank to clean it, I found the air too impure to breathe. Apparatus for purifying it was not available, so I cut a hole in a piece of tin to take the end of a length of garden hose, and then taped it over the air-exhaust opening of a vacuum cleaner, which was placed to blow fresh air into the tank. This enabled me to continue the work of cleaning, and also furnished a means of driving out the fumes when painting the inside of the tank.—James H. Brundage, New York City.

Razor Blade Attached to Compass for Cutting Gaskets

Disks of cardboard, or gaskets, can be cut out with a compass and a razor blade as shown. The blade is fastened to one leg



of the compass, and after the latter has been set for the size of circle desired, it is used in the ordinary way, with the exception that more pressure, of course, should be exerted on the leg holding the blade.

Wires Lubricated with Soap Easily Pulled through Conduit

If slightly dampened soap flakes are sifted on insulated wire, it is easily pulled through a long conduit. The flakes should not be wet, but just dampened enough to make them adhere to the wire. The soap acts as a lubricant and eliminates friction between the conduit and the wire.



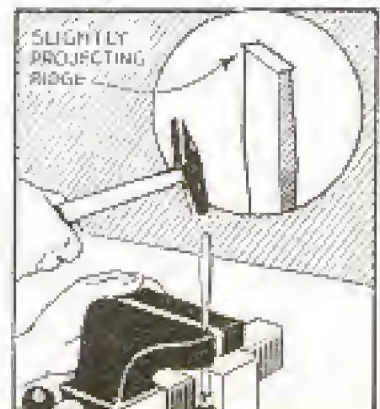
Farm-Wagon Chassis, Which Carries a Number of Fuel Tanks Besides a Large Tool Cabinet, Saves Much Time and Effort

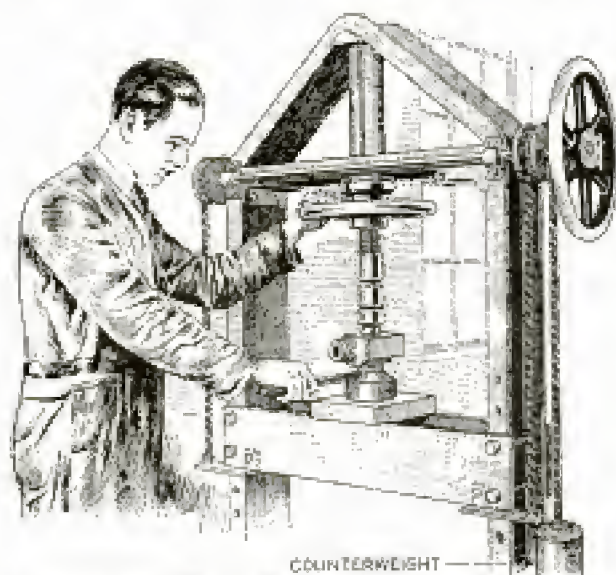
Handy Farm Fuel and Repair Cart

Combining his fuel tanks and tool chest together on a wagon frame, an Illinois farmer eliminates much lifting of cans in and out of a wagon or truck, and also saves much time otherwise spent in going after equipment. A frame of 2-in. stock, with cut-outs to hold the oil barrels, was built on an old wagon chassis. On the front end of the wagon a large tool chest was built, the top being covered with roofing paper to protect the interior, and hinged doors were attached to the front, while a sliding drawer was provided at the bottom for small tools. To hold the barrels securely, metal hands are slipped over them and are bolted to the frame.

Flared Point Improves Screwdriver

If the edges on the point of a screwdriver are slightly flared, it will grip a screw much better. First grind the blade in the usual way and, after clamping it in a vise, tap the tip of the point with a hammer until the edges are slightly flared out as indicated in the detail. Treated in this manner, the edges will bite into a screw head and grip it much more firmly.





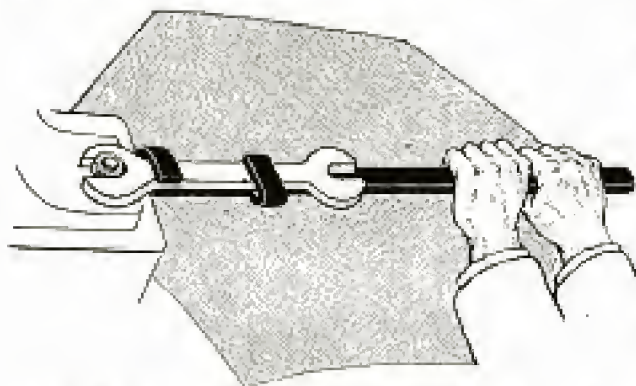
Counterweight Fastened to Heavy Press Table Allows Workman to Raise or Lower It with Ease

Counterweight Helps Raise Heavy Press Table

Heavy press tables can easily be raised and lowered by using the illustrated counterweight. A shaft, with a 6-in. flanged pulley mounted on each end, is fastened across the top of the press by means of two bearings bolted to the frame. Chains, fastened to the bottom of the table, run over the pulleys. One chain is fastened to its pulley over which it runs, while the other extends down and has a counterweight fastened to it. A large handwheel mounted on the longer end of the shaft, enables the worker to raise or lower the table single-handed.

Wrench Extension Is Handy Addition to Tool Kit

Made of flat iron, with two lugs at one end, which are bent in opposite directions as shown, this wrench extension requires



This Flat-Iron Extension for Use on Wrenches Provides Additional Leverage for Obstinate Nuts

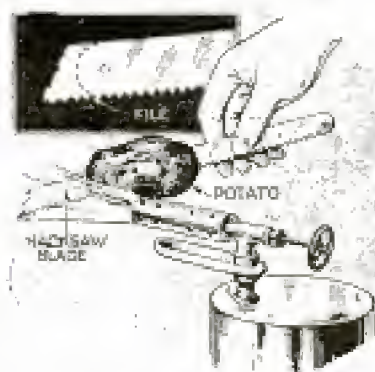
little space in the plumber's tool kit and will often be found useful when obstinate nuts are encountered. The stock used for making this extension depends largely upon the size of wrenches on which it is to be used. A heavy piece is necessary on large wrenches where considerable leverage is employed, while a lighter extension will suffice for smaller ones.

An Efficient Polishing Cloth

To make an efficient polishing cloth, dissolve 1 oz. of oxalic acid (poison) in 1 gal. of water. When the solution is complete, sift in 1 lb. of ordinary whiting and mix with a stick. Soft pieces of cloth, such as flannel, when saturated with this mixture, gently squeezed out and allowed to dry, make good polishing cloths. While saturating the cloth with the preparation, the mixture should be kept well stirred to prevent the whiting from settling. Cloths prepared in this manner may be stored in envelopes for use when needed.

Salvaging Broken Hacksaw Blades

If a hacksaw blade breaks near the end, there is no necessity of throwing it into the scrap heap. Heat the broken end to a dull red, preventing the heat from running up the blade by means of a potato as shown in the drawing. Allow the heated portion to cool gradually and then drill a hole in it to fit the pin of a saw frame.



Rubber Bumper Protects Handle of Bricklayers' Hammer

Bricklayers often experience trouble by having the handles of their hammers splintered in tapping bricks into position. This annoyance can be overcome by nailing a piece cut from a rubber heel onto the end of the handle. This absorbs the jar and also protects the worker's hands.

General Utility TRANSFORMER



Delivers
from 2 to 22 Volts

DELIVERING from 2 to 22 volts, a small step-down transformer can be used for operating doorbells, door openers, toy trains, small motors, Christmas-tree lights connected in parallel, signs with low-voltage lamps, tungsar rectifier bulbs, thermostats, etc. Of course, a transformer can only be used in an alternating-current line and the one described here is designed for 110 volts at 60 cycles.

The iron core is built up from stovepipe iron, and as the core is square, all its layers are the same size. As shown in Fig. 2, the pieces are $1\frac{1}{8}$ by $4\frac{1}{8}$ in. in size, and if the iron is No. 26 gauge, as stove iron generally is, approximately 330 pieces will be required for the four legs. The thickness of the core is also $1\frac{1}{8}$ in., when compressed in a vise. While it is possible to cut the core pieces by hand with tin snips, it is a rather tedious job and wholly unnecessary, as most sheet-metal shops have either a foot or power-operated shears on

TOP PIECES INSERTED
AFTER COILS ARE PLACED

FIG. 1

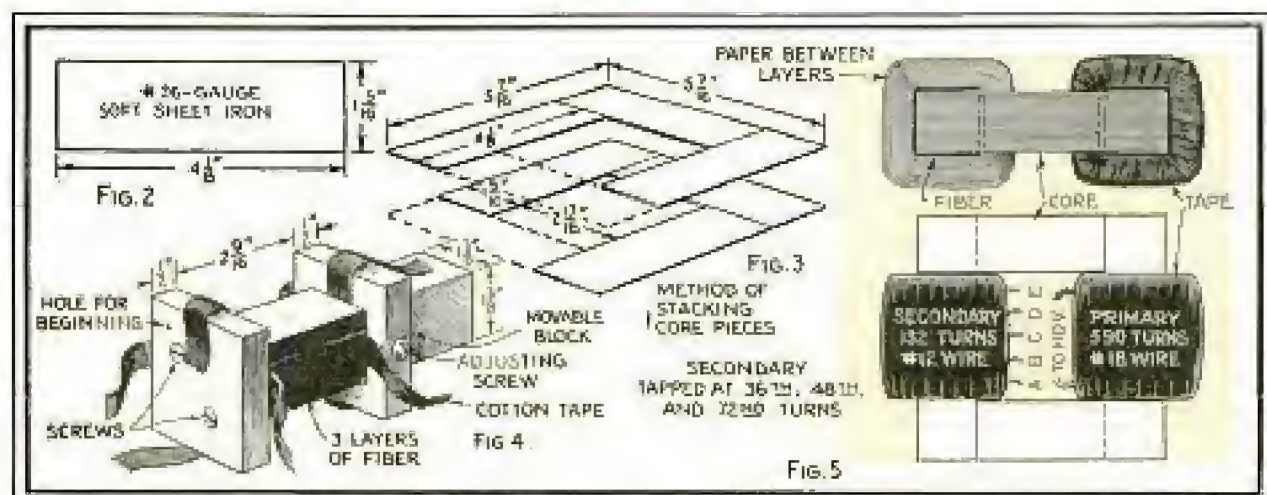
LEGS $1\frac{1}{8} \times 1\frac{1}{8}$

NO. 8-32
MACHINE
SCREW
2" LONG

NO. 18 HOLES

CORE ASSEMBLED AND
READY FOR COILS

which the work can be done quickly, much more accurately than by hand and at small cost. In all probability you can have the material cut at the shop where you purchase it. Fig. 3 shows the method of stacking the iron laminations. One end of the core is omitted so that the coils, which are wound on a form, may be slipped over the legs before the end lami-

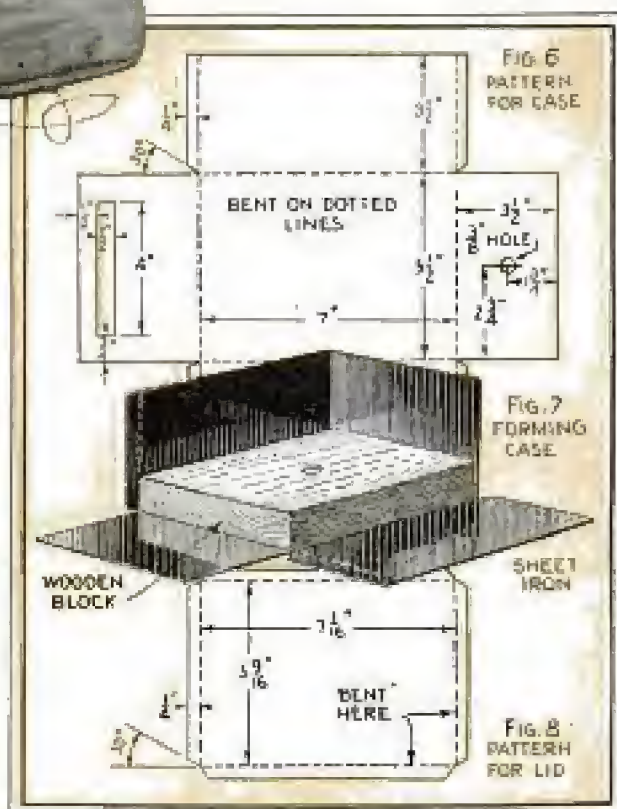




nations are woven in. Friction tape, or rubber bands, are used to hold the stacks together before clamping between pieces of $\frac{3}{4}$ by $\frac{3}{4}$ -in. angle iron, as shown in Fig. 1. Four holes are drilled in each clamp, two for machine screws with which the two clamps are drawn together, and the other two for fastening the completed transformer into the case, as will be explained later. Of course, four clamp pieces are needed.

The winding of the coils is done on a form, as shown in Fig. 4. Notice that the form has a movable end to allow quick removal of the coils. The form shown consists of a block of wood, slightly larger than a leg of the core, so that the coil, after being wound, can readily be slipped over the leg. The primary coil is wound first. It has 590 turns of No. 18 s.c.c. enameled wire. The length of the coil is $2\frac{9}{16}$ in. Set the movable block on the coil form to this length and fasten with a set-screw. Now cut four pieces of $\frac{1}{2}$ -in. cotton tape, 8 in. long, and place these in the form as indicated. A bit of gummed paper may be used to hold them in place temporarily. Next, wrap two or three layers of fiber paper, cut exactly $2\frac{9}{16}$ in. wide, around the form. If fiber is not available, waxed cardboard from a cracker box may be substituted. The eight tape ends are held out of the way with thumbtacks pushed into the edges of the end blocks. Insert one end of the wire in the starting hole of the form and pull out a length of about 8 in. Then start winding. Keep the turns close together and place a single sheet of waxed paper, previously cut to size, between consecutive layers. Try to

put the same number of turns in each layer except the last so that, if you lose count, it will be easier to check back. After you have wound the 590 turns, cut off the wire, allowing an 8-in. lead, and tie the coil tight with the four tapes. The end block is then removed and the coil carefully taken off the form. Taping the coil consists in wrapping it with a single overlapping layer of $\frac{1}{2}$ -in. cotton tape the long way of the coil. The tape is held in place by shellacking the entire coil inside



and out. The winding of the secondary coil is similar, except that it is tapped for various voltages. The secondary has 132 turns of No. 12 s.c.c. enameled wire tapped at the 36th, 48th and 72d turns. This is done by allowing an 8-in. loop to extend at these points. The tying, taping and shellacking is the same as for the primary coil. The taps should be twisted so that the tape will hold them in place. Loop a piece of wire through the coil so that it may be hung up while the shellac is drying.

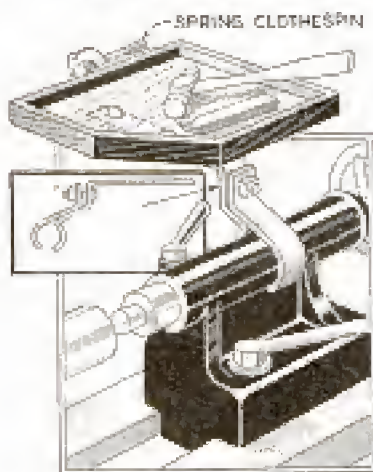
After the coils are dry, they are slipped over the legs of the core. Be sure that the laminations are all in line so that a sharp corner does not cut through the tape and fiber, causing a short circuit between a few

turns of the coil. After both coils are placed, the end laminations are carefully woven into the spaces left in the legs, and then the second pair of clamps are attached. The case is a piece of sheet iron, bent as in Figs. 6 to 8 inclusive. The metal and a block of proper size are screwed to the bench top and the four sides are bent up by hand. The bottom bend is squared up sharp by simply placing a block against the corner and striking the edge of the block with a hammer. Solder is used to fasten the corners, and also the lid, to the box after the transformer has been installed. The latter is held in place by running machine screws through the sides of the metal box into the tapped holes in the angle-iron clamps.

The lead to the 110-volt house circuit is carried through a hole in the end of the metal case. A hard-rubber bushing should be used here to prevent the metal from cutting into the cord. On the other end of the case a strip of bakelite or hard rubber is screwed over the slot. This strip carries five binding posts to which the secondary taps are connected. A coat of black lacquer or enamel over the entire case completes the job.

The following voltage combinations are possible between the various taps: B to C, 2 volts; C to D, 4; A to B, 6; A to C, 8; D to E, 10; A to D, 12; C to E, 14; B to E, 16, and A to E, 22 volts.

Tray Clamped to Lathe Tailstock



Machinists will find this tray convenient as it holds the tools at hand near the work. A flat-metal clamp is made to fit the tailstock and is screwed or bolted to the bottom of the tray. For holding delicate

instruments separately, so that they do not come in contact with the other tools, a spring clothespin may be attached to the outer edge of the tray, as indicated.



Strip of Wood Nailed to Side of Ladder Serves as Guide for Sawing Wallboard

Guide on Side of Ladder Is Useful for Sawing Wallboard

For sawing plasterboard and wallboard, which usually is a rather awkward task, a Wisconsin carpenter uses a guide nailed to the side of his ladder as shown. It consists of a strip of 1-in. stock separated from the ladder by a spacing block at each end. With this guide, it is an easy matter to saw across a strip of board at right angles without the customary procedure of laying off a guide line on it.

Reaming Wristpin Holes in Pistons

In the absence of a suitable reamer, it is a comparatively simple matter to enlarge the wristpin holes of a piston by grinding four cutting lips on the end of one of the new pins to be used. The reamer thus improvised is held in the chuck of the lathe while the piston is held against the dead center, after which the tailstock spindle is moved forward.—S. A. Asquith, Los Angeles, Calif.

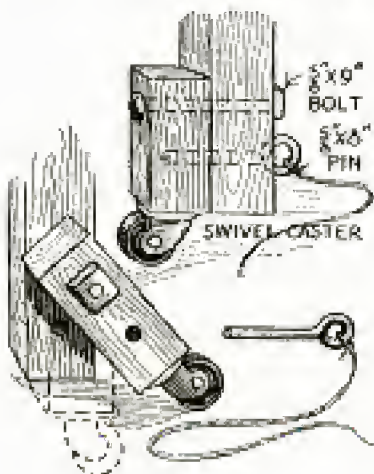
☛ To test the edge of tools, keep a piece of hardwood dowel rod handy in your kit.



This Rotary Tool Rack Swivels on Anvil Block

Swiveled to the anvil block, this table keeps the blacksmith's tools handy at all times. The support arm is made of 1¼-in. iron rod, bent at one end to fit into a clevis which is attached to the block by means of large screweyes. The other end of the arm is bent to a U-shape to take the pivot bolt, which is fastened to the center of the table as shown to the left in the illustration.—True Parker, Lula, Ga.

Workbench Legs Fitted with Casters for Easy Moving



Having a heavy workbench that had to be moved around in the shop frequently, I made the illustrated caster attachment. The casters are fastened to short blocks pivoted to the

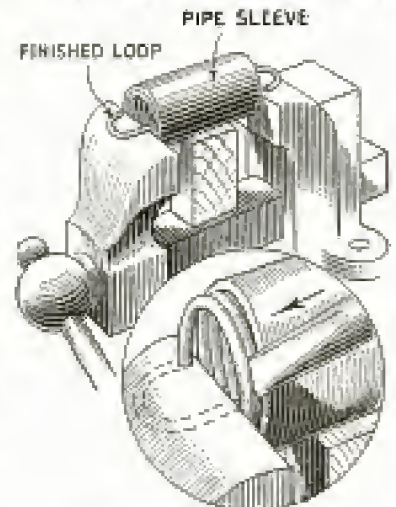
legs so that they can be turned up to allow the bench to stand up to allow the bench to stand firmly when in use. Holes are drilled through each leg and into the blocks for insertion of pins that hold the legs in rigidly when the bench is being moved.—H. Kerran, Plainwell, Mich.

Reversing Motor-Flywheel Gear Prolongs Life of Teeth

When teeth on the flywheel of a car become worn so that the starter pinion sticks on coming in contact with them, the trouble can often be overcome by reversing the gear on the flywheel to present the unworn side of the teeth to the pinion. To do this, remove the wheel, heat the gear with a blowtorch to expand it, after which it can readily be removed by tapping gently with a hammer. Then heat the gear again and slip it back on the wheel in a reversed position. It is necessary, of course, to replace the gear so that it is true with the flywheel. This often will make the teeth last months longer.

Forming End Loops on Coil Springs

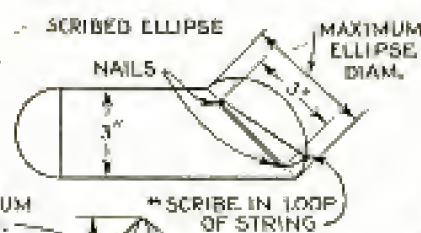
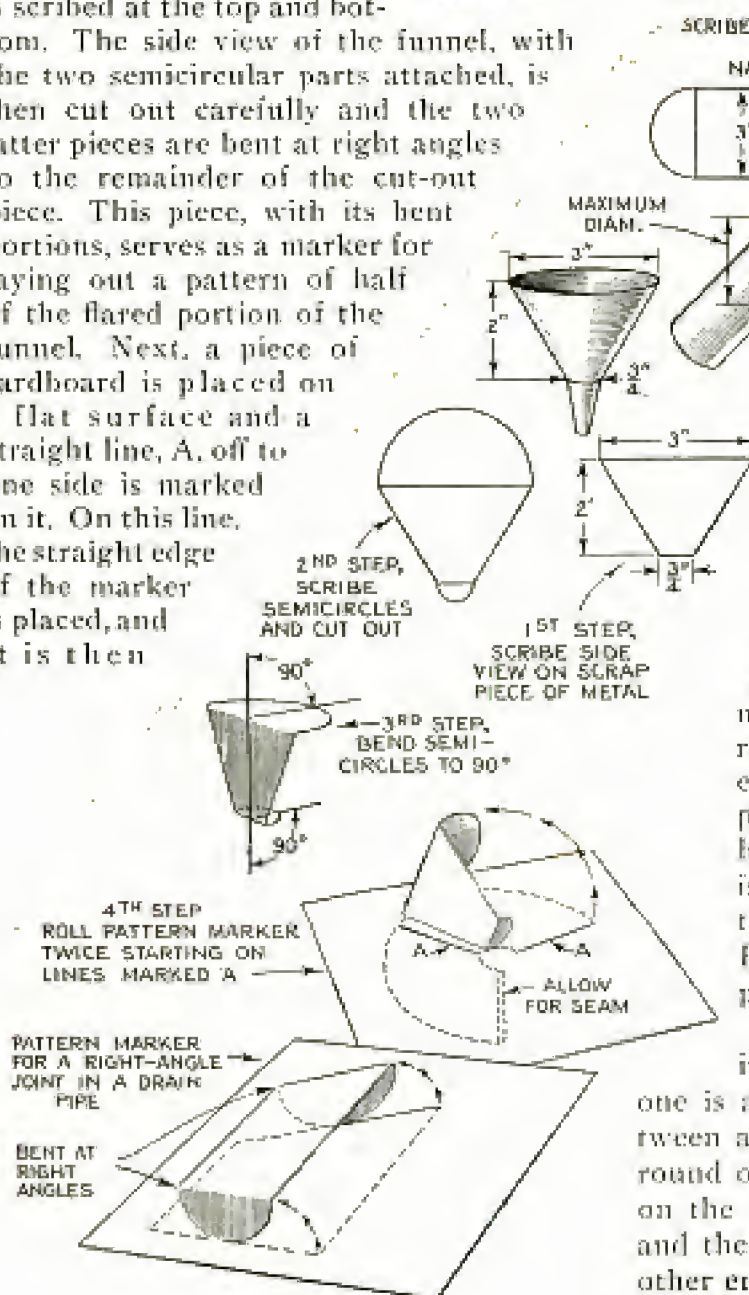
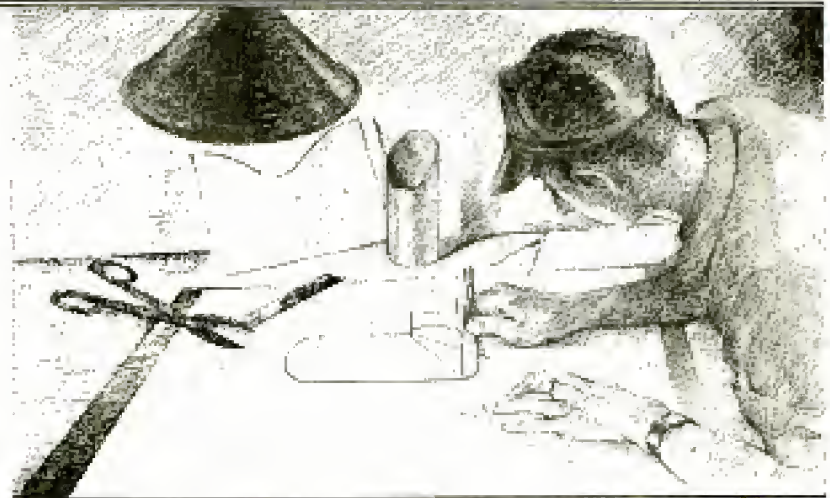
Difficulty experienced when forming the end loops on a coil spring can be lessened by fitting a pipe nipple over it to prevent buckling and then placing it in a vise. With a chisel open the end coil, and with a hammer it can then be bent over the vise jaw at right angles to the coil.



❖A stereotype that will not make a good print because of roughness in the mat from which it was made, can be polished by rubbing it with smooth paper until the high spots are removed.

Short Cuts That Help Simplify Tinsmithing

A funnel offers a good starter for handling sheet-metal problems. It is made from two patterns or parts, the upper or flared portion and the bottom or spout, to be joined together by soldering. The first step is to get a piece of scrap metal and to scribe a scaled picture of the side of the flared portion on it. Then, as the funnel is round, a semicircle is scribed at the top and bottom. The side view of the funnel, with the two semicircular parts attached, is then cut out carefully and the two latter pieces are bent at right angles to the remainder of the cut-out piece. This piece, with its bent portions, serves as a marker for laying out a pattern of half of the flared portion of the funnel. Next, a piece of cardboard is placed on a flat surface and a straight line, A, off to one side is marked on it. On this line, the straight edge of the marker is placed, and it is then



rolled to the left on the semicircular edges so that they leave an imprint on the paper. When the opposite straight edge touches the paper, another line, A, is drawn, as indicated. The marker has thus developed on the flat sheet a pattern for one-half of the upper flared portion. To complete the pattern, place the edge of the marker on the last made line, again roll it to the left until its opposite edge comes in contact with the paper, and draw a line (dotted in illustration). All that remains now is to add sufficiently to the pattern to provide for a seam, as shown. For the pattern of the spout the procedure is exactly the same.

If the object to be made has openings other than circular, or if only one is a circle, such as a connection between a square or rectangular flue and a round one, a semicircle should be scribed on the round end of the pattern marker and the square or rectangle made on the other end. By allowing the marker to roll



on the round end, and to roll up on the corners of the attached rectangle or square as the rolling progresses, a true pattern will result. The square or rectangle should not be the full rectangle or square that is desired in the finished pattern but only half of it. Do not forget to allow for the overlapping of edges wherever a seam is to be made.

In the joining of two cylindrical pieces that do not connect in a straight line but meet at an angle, the shape of the jointure is an ellipse. The short diameter of this ellipse is equal to the diameter of the cylinders, while its long diameter is represented by a line scribed at the proper angle on the side view of the pattern marker. By locating the short diameter in the exact center of the longer one, and driving two nails through to mark its ends, the ellipse can be scribed. Simply loop a piece of string about the two nails and tie it so that the loop will reach to the end of the maximum diameter but no further. Insert the scribe and scratch the ellipse. Bend this semiellipse back 90° as is done with the semicircles or half rectangle.—Norman V. Davidson, San Diego, California.

Fence Posts Made from Bed Rails

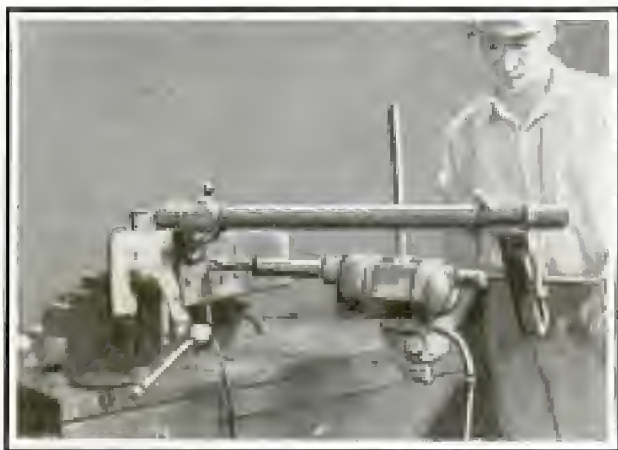
Old bed rails set in concrete make good fence posts. Wire is attached to eyebolts run through holes drilled in the rails. The holes should be so large that the eyes almost come through the posts, and the wire

is pulled taut by tightening the nuts on the bolts. Such fencing is good for use around lawns, gardens, etc., and makes a neat job, but is too expensive for long lines.

Mount for Portable Electric Drill

For holding a portable electric drill, in either a vertical or horizontal position, a practical mount can be made from a 3-in. length of 2-in. pipe, clamped to the work by two setscrews and a col-

lar which bears against a metal projection welded at right angles to the pipe. The rear handle of the drill is removed, the shank inserted in a loose sleeve on the end of a $\frac{3}{4}$ -in. feed screw 12 in. long, and is held in place by a dowel pin projecting into a slot in the screw. It is adjusted with a short handle at the rear and is held in a nut, flattened on two sides to fit into the hollow arm of the device and is threaded for a large tension gland at the rear. The gland pulls against a solid collar turned on the feed screw near the middle. This holds the butt of the drill at any point along the arm, which is fitted over the pipe by a collar and setscrew and may be used in a circle about the pipe. A $\frac{1}{8}$ -in. hole, drilled lengthwise through the feed screw, enables the operator to sight



Improved Mount Holds Electric Drill in Either Vertical or Horizontal Position

for the center of a hole to be made before inserting the drill.

Cure for "Limberneck" in Poultry

"Limberneck," a nervous disease of poultry, otherwise known as botulism, occurs in hot weather if the flocks are allowed to feed on decayed matter. To prevent the disease, remove all such matter so the poultry cannot get at it. The standard treatment is to dissolve 1 lb. of Epsom salts in 3 gal. of water for every 100 birds. This mixture is given instead of the regular drinking water.

Parting Work on Lathe Having Loose Bearings

In order to keep the parting tool from jumping or biting into the work in a lathe that has loose bearings, I placed the tool upside down and run the lathe backward. In this way, the pressure of the tool on the work tends to hold the lathe shaft firmly against its bearings.—Warren L. Miles, Providence, R. I.

Metal Frame Holds Waste-Paper Bag



Metal tripods, such as those used by Culver Military Academy to hold waste-paper bags, can be made by riveting three legs to a metal band as shown. The legs are bent

over at the bottom and the ends riveted or welded together at the center, to obtain the required rigidity, and also to provide support for the bottom of the bag. In use, the edges of the bag are folded over the band and fastened with a string.

Lustrous and Durable Stove Polish

You can make a lustrous and durable stove polish by thoroughly mixing 1 lb. of plumbago with sufficient water glass to make a paste. The paste should be stored in a tightly sealed container to prevent evaporation. If the water evaporates from the polish, the hard tacky mass remaining is entirely useless.



Starting Board Nailed Diagonally across Joists in Center of Room Permits Working Both Ways

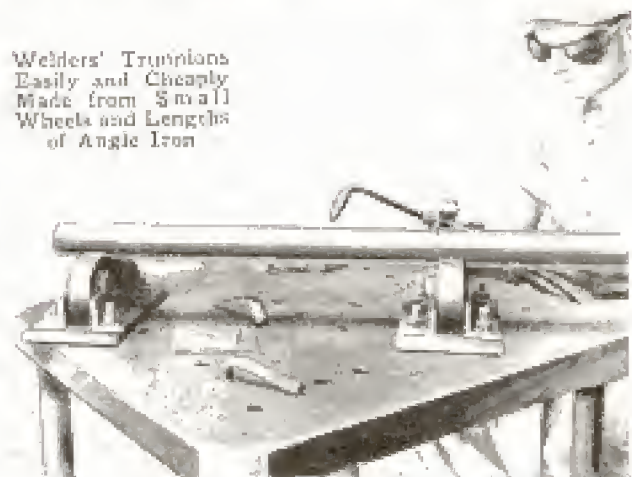
This Kink Speeds Laying of Floors

When laying rough floorboards at an angle, the work can be speeded up by the following procedure: Nail the first board diagonally across the center section of the space to be covered and then more men can work on the floor.—H. H. Siegle, Emporia, Kan.

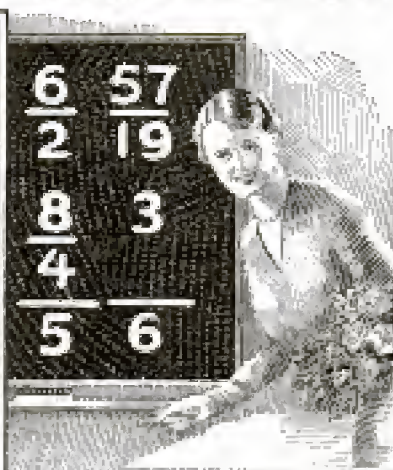
Trunnions Are Helpful in Welding Round Work

A set of trunnions, made from wheels taken from old hand trucks, is useful in welding pipe or other round work. The wheel axles are welded in position between two 4-in. lengths of angle iron, which are slotted and bolted to a piece of $\frac{1}{2}$ -in. iron plate, the slots allowing adjustment of the wheels to accommodate work of various sizes. Two of the truck wheels are used on each section of the angle iron.

Welders' Trunnions Easily and Cheaply Made from Small Wheels and Lengths of Angle Iron



Can You Solve *these* Puzzles?



TWO mechanics, inventorying their stock, were inspecting a grindstone. "Put it down at half the cost," said one of them, "for I figure we have ground off half of the original bulk." If the other part owner finds the circular stone has a present diameter of $15\frac{7}{8}$ inches and its central hole for the shaft measures $3\frac{1}{2}$ inches in diameter, what was the original diameter if the stone's present bulk represents fifty per cent? The hole for the shaft means a reduction from the bulk.

"**G**IVE me a pound and a quarter of snappy cheese for boarders," ordered a customer at the delicatessen store as she placed the correct amount of money on the counter. Henry cut off a piece and, after weighing it, remarked: "It runs

By SAM LOYD
1531 Salsey, Brooklyn, N.Y.

twenty-five cents over." "Then give me half of the piece you have cut," said the landlady, taking back a dime of the money she had laid out. How much cheese did the boarders get?

SAID Mrs. Terwilliger to her class: "Here we see how the even digits can be arranged to total 5, and the odd digits arranged to total 6. Now, I want you to arrange the nine figures into two other sums, which will total alike, that is, the four odds will be made to equal the five evens." Improper fractions need not be used.

Answers to Last Month's Puzzles

If the number of feet in the perimeter of the Greek cross was equal to the number of square yards in its area, the perimeter would have to be $259\frac{1}{2}$ feet long. Solving algebraically, we call one side of the small squares X feet. Then the perimeter of the figure would be 12X feet. Its area would be 5X square feet. Since there are nine square feet in a square yard, the figure's area in square feet would be nine

times the number of feet in the perimeter. Thus the equation: Five times the square of X equals nine times 12X, the solving of which gives the value of X as $21\frac{1}{2}$ feet.

In solving Mrs. Terwilliger's puzzle, the foxes and geese can be transposed by the following ten moves: Fox 3 to 2; goose 5 to 8; fox 4 to 1; goose 6 to 7; fox 2 to 5; goose 7 to 4; fox 1 to 7; goose 8 to 2; fox 7 to 6, and goose 2 to 3.

U.S. PATENT

1852265 • ISSUED APRIL 5, 1932



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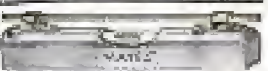
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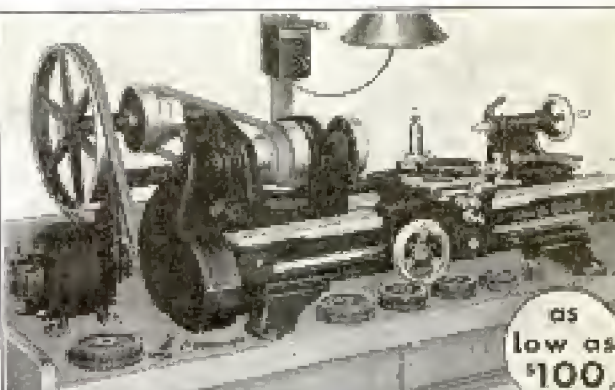
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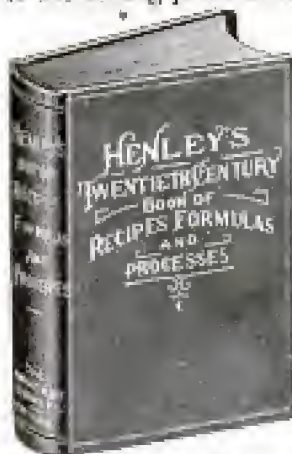


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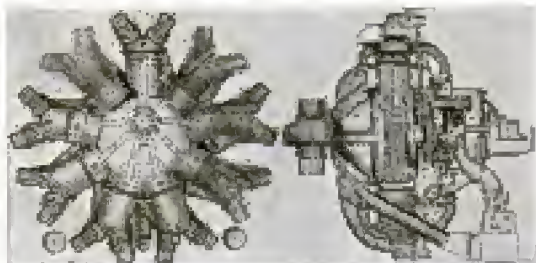
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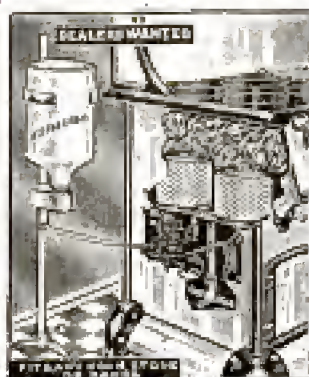
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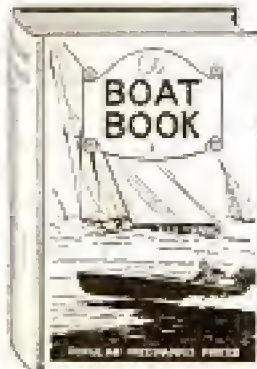
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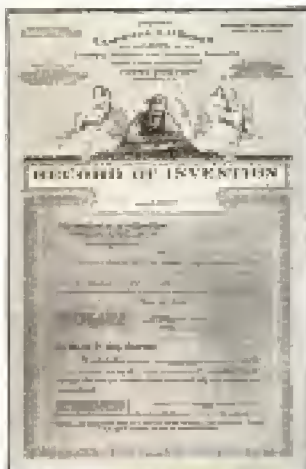
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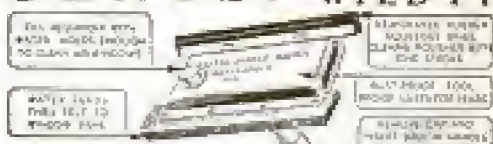
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